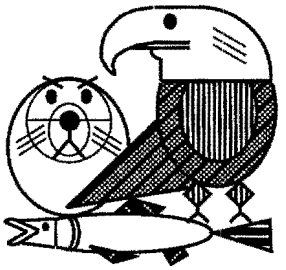
13.08.01 October 1994 (2 of 2)

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



MEMORANDUM

To: Trustee Council

From: James R. Ayers
Executive Director

Date: October 18, 1994

Re: Appraisal Process

During our last Trustee Council meeting we discussed the habitat protection effort and you requested that I report further regarding the standardized appraisal process adopted by the Council. The process, as actually implemented, has proven to contain flaws which must be overcome immediately if the Council's efforts are to be successful.

The first major flaw is the matter of accomplishing appraisal tasks on schedule within a predictable level of costs. The delay and costs associated with completing the appraisals is still being reviewed. I suspect that it is safe to say that we now realize that we have far more work than can be accomplished in a timely manner by one appraiser and one timber cruiser, irrespective of their good faith assurances. It is my understanding that the U.S. Forest Service will have a report to you by the November 2 - 3 meeting on the expenditures the Council has incurred on the appraisal process up to this point and related time lines.

The second and more substantial flaw is that the appraisals contracted for by the Trustee Council contain superfluous, subjective opinions that are inappropriate under all applicable appraisal standards. The inclusion of these superfluous opinions not only reflects poorly on the Trustee Council itself, but jeopardizes the ability to complete transactions with the interested sellers because of a perceived lack of objectivity in the appraisal. There has been insistence that no one be permitted to examine either the draft and interim approved appraisals or the review statements prior to release other than a review appraiser. This "closed" review process shielded these documents from a review that would have identified superfluous, inappropriate and subjective opinions and would have maintained the objectivity of the appraisal process.

During my Assistant Secretary-level meetings last week in Washington, I found strong support for the need for final appraisal reviews by senior appraisal officials to restore credibility to this process. In accordance with Federal regulations governing review

appraisals, the review of the three Kodiak appraisals is now being conducted by the Chief Appraisers of both the Forest Service and the Fish and Wildlife Service. The interim approval of the Kodiak appraisals has been rescinded by the two Federal Chief Appraisers in order to correct the superfluous and inappropriate language that had been included. The State of Alaska's Chief Appraiser will continue to play a material and integral role in this final review. The Chief Appraisers have advised their agencies that this process can be completed within the week. The product of the Chief Appraisers' review will be the appraised value for the property and will then be used as the basis for the negotiation process under our standardized procedures.

The Kodiak appraisal process is slightly more advanced than that for the other parcels under consideration for acquisition. As a result, we will have an opportunity to assess the results of this Kodiak review and determine whether permanent changes in the standardized process must be made. I remain optimistic that we can work with the willing sellers to put these problems behind us in the final negotiations.

jra/raw

All Documents Faxed to the Trustee Council Must Be Followed Up
With Phone Calls To Ensure Arrival and Delivery
This Confirmation Sheet **MUST** be Attached to the Completed Faxed Document

X Mr. Janik (Renee) John Clark 8:12 10/19
586-8863 Date & Time: 10/19 8:24 (yes)

X Mr. Frampton (Cathy) lft msg 8:56 10/19 11 11:10 11:44 sent again
202-208-4416 Date & Time: (yes) 12:15 10/19 to ofc & to 595-1425

X Mr. Pennoyer (Linda) Barbara (yes)
586-7221 Date & Time: 8:28 10/19

X Mr. Rosier (Carla) 8:36 sent again
465-4100 Date & Time: yes 11 11 Princess Hotel 455-5094 Pls hold for arrival

X Mr. Sandor (Martha) martha (yes)
465-5050 Date & Time: 8:30 10/19

X Mr. Tillery (Vicki) (yes) 10/19
269-5274 Date & Time: 8:53 Vicki

___ Mr. Wolfe (Pat)
586-8870 Date & Time: _____

X Ms. Williams (Wanda) karen (yes)
271-5485 Date & Time: 8:54 10/19

Description of Document: 3 pg memo to TC re: Appraisal Procen.

Comments: Rosier @ Princess Hotel until Friday, sent there also.

Your Initials:

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178

FAX COVER SHEET

To: Trustee Council Number:

From: Jim Ayers Date: 10-18-94

Comments: Total Pages: 3

Pls forward to the Trustee Council Member in your ofc. Thank You

Cathy - 2nd try.

PHONE MEMO

TO Rebecca DATE 10/19 TIME 12:15 AM PM

FROM

OF Trampton got fax AREA CODE NO. EXT.

MESSAGE

SIGNED

PHONED ☑ CALL BACK ☐ RETURNED CALL ☐ WANTS TO SEE YOU ☐ WILL CALL AGAIN ☐ WAS IN ☐ URGENT ☐

Document Sent By: Rebecca

9/9/94

****
*** MULTI TRANSACTION REPORT ***
****

TX/RX NO. 3167

INCOMPLETE TX/RX	[25] 19075867840	P.JANIK
	[37] 2714102	D.WILLIAMS
TRANSACTION OK	[09] 19075867589	J.AYERS
	[26] 19074652075	B.BOTELHO
	[28] 19075867249	S.PENNOYER
	[29] 19074652332	C.ROSIER
	[31] 19074655070	J.SANDOR
	[36] 2787022	ALEX-CRAIG
ERROR	[27] 12022084684	G.FRAMPTON

****
*** ACTIVITY REPORT ***
****

TRANSMISSION OK

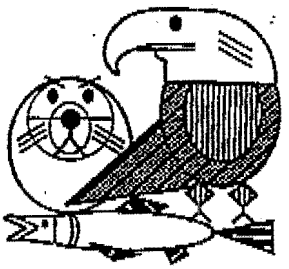
TX/RX NO.	3171
CONNECTION TEL	19075867840
CONNECTION ID	P.JANIK
START TIME	10/19 08:13
USAGE TIME	01'21
PAGES	3
RESULT	OK

****
*** ERROR TX REPORT ***
****

TX FUNCTION WAS NOT COMPLETED

TX/RX NO.	3167
CONNECTION TEL	19075867840
CONNECTION ID	P.JANIK
START TIME	10/18 17:10
USAGE TIME	00'00
PAGES	0
RESULT	NG 0 #018

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



FAX COVER SHEET

To: Trustee Council Number:

From: Jim Ayers Date: 10-18-94

Comments: Total Pages: 3

Pls forward to the Trustee Council Member in your Ofc. Thank You

****
*** MULTI TRANSACTION REPORT ***
****

TX/RX NO. 3172

INCOMPLETE TX/RX

TRANSACTION OK [27] 12022084684 G.FRAMPTON

[37] 2714102 D.WILLIAMS

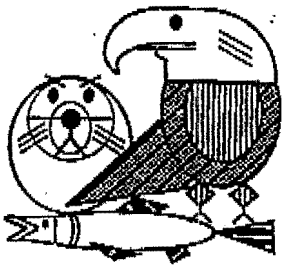
ERROR

****
*** ERROR TX REPORT ***
****

TX FUNCTION WAS NOT COMPLETED

TX/RX NO.	3167
CONNECTION TEL	12022084684
CONNECTION ID	G.FRAMPTON
START TIME	10/18 16:53
USAGE TIME	02'04
PAGES	3
RESULT	NG 1

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



FAX COVER SHEET

To: Trustee Council Number:

From: Jim Ayers Date: 10-18-94

Comments: Total Pages: 3

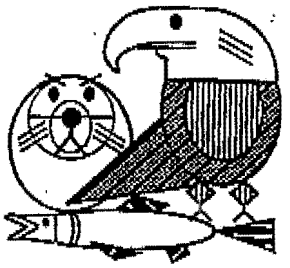
Pls forward to the Trustee Council Member in your Ofc.. Thank You

****
*** ERROR TX REPORT ***
****

TX FUNCTION WAS NOT COMPLETED

TX/RX NO.	3167
CONNECTION TEL	2714102
CONNECTION ID	D.WILLIAMS
START TIME	10/18 17:12
USAGE TIME	00'00
PAGES	0
RESULT	NG 0 #018

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



FAX COVER SHEET

To: Trustee Council Number:

From: Jim Ayers Date: 10-18-94

Comments: Total Pages: 3

Pls forward to the Trustee Council Member in your Ofc.. Thank You

****
*** ACTIVITY REPORT ***
****

TRANSMISSION OK

TX/RX NO.	3175
CONNECTION TEL	4555094
CONNECTION ID	
START TIME	10/19 08:34
USAGE TIME	02'01
PAGES	4
RESULT	OK

****
*** ACTIVITY REPORT ***
****

TRANSMISSION OK

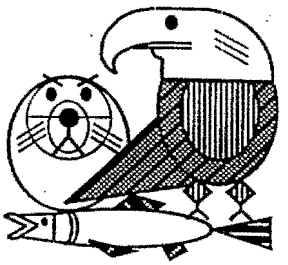
TX/RX NO.	3176
CONNECTION TEL	19074652332
CONNECTION ID	C.ROSIER
START TIME	10/19 08:37
USAGE TIME	02'06
PAGES	3
RESULT	OK

****
*** ACTIVITY REPORT ***
****

TRANSMISSION OK

TX/RX NO.	3186
CONNECTION TEL	12022084684
CONNECTION ID	G.FRAMPTON
START TIME	10/19 11:42
USAGE TIME	01'41
PAGES	3
RESULT	OK

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



FAX COVER SHEET

To: Commissioner Carl Rosier Number: 455-5094

From: Jim Ayers Date: 10-19-94

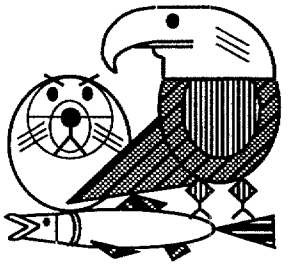
Comments: Total Pages: 4

Please hold for the arrival of Commissioner Carl Rosier this afternoon. Thank you!!

Document Sent By: Rebecca

9/9/94

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



MEMORANDUM

TO: Mark Brodersen/ADEC

FROM: Molly McCammon, Director of Operations

DATE: October 17, 1994

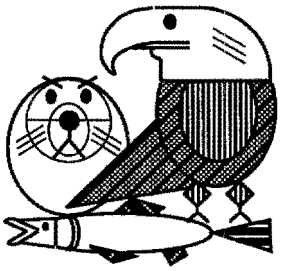
SUBJ: LGL Infomation Request — Project Budget Information

As you can see from the enclosure, the Anchorage Restoration Office recently received a request for information from Ms. Bobby Pearson on behalf of LGL Alaska Research Associates, Inc. regarding the cumulative funding for several on-going Trustee Council projects. Your long-term understanding of Trustee Council budgets and funding could be of help to Jerome and Byron and I would appreciate it if you could assist as needed in preparing a response to the information request from LGL.

Thank you.

enclosure

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



MEMORANDUM

TO: Jerome Montague/ADFG
Byron Morris/NOAA

FROM: Molly McCammon, Director of Operations

DATE: October 17, 1994

SUBJ: LGL Infomation Request — Project Budget Information

The Anchorage Restoration Office recently received a request for information from Ms. Bobby Pearson on behalf of LGL Alaska Research Associates, Inc. regarding the cumulative, historical funding for several on-going Trustee Council projects. ADFG is the lead for all but one of the projects. These projects (as proposed for continued funding in FY 95) include the following:

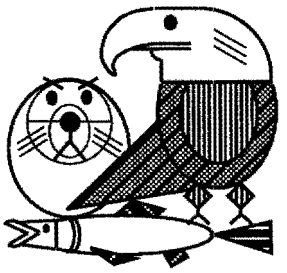
95165	PWS Herring Genetic Stock Identification
95191A	Investigation/Monitoring Oil & Egg - Alevin Mortality
95191B	Investigation/Monitoring Oil & Egg - Alevin Mortality (lab)
95255	Kenai River Sockeye Restoration
95320D	PWS Pink Salmon Genetics

The purpose of this memorandum is ask for your assistance to prepare a simple spreadsheet that would show funding over time for these projects. As you can appreciate, since some of these projects extend backwards in time and have evolved from damage assessment to restoration projects, your help in describing long-term, cumulative funding for these efforts is especially needed. Ms. Pearson has indicated that LGL was especially interested in documenting the expenditures attributable to genetics research. If you have questions regarding the specific interest LGL has in these projects, please contact Ms. Pearson at LGL (562-7223). Because of his long-standing familiarity with Trustee Council budgets, I have also asked Mark Brodersen to please assist in this effort if he can.

cc: Mark Brodersen

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



MEMORANDUM

To: Cathy @ G. Frampton's Office
Renee @ P. Janik's Office
Linda @ S. Pennoyer's Office
Carla @ C. Rosier's Office
Martha @ J. Sandor's Office
Vicki @ C. Tillery's Office
Wanda @ D. Williams' Office

From: Rebecca Williams RAW
Exxon Valdez Restoration Office

Date: October 14, 1994

Subj: Confirmed Start Times for November 2 & 3 Trustee Council Meetings

---

Start times for the November 2 & 3, 1994, Trustee Council meetings in Anchorage are as follows:

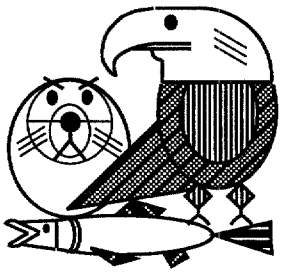
- **November 2 at 10:00 a.m.**
- **November 3 at 8:30 a.m.**

An agenda will be distributed when it is available. If any of you have any questions, please don't hesitate to contact me (265-9326 desk or 278-8012). Have a good weekend.

Thank you!

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



MEMORANDUM

To: ✓Cathy @ G. Frampton's Office 11/1 4414
Renee @ P. Janik's Office
✓Linda @ S. Pennoyer's Office ok. coming in on 11/1
✓Carla @ C. Rosier's Office 10:00 a.m.
✓Martha @ J. Sandor's Office ok for Sandor
✓Vicki @ C. Tillery's Office ok. Bruce Botelho ok.
Wanda @ D. Williams' Office

From: Rebecca Williams RWW
Exxon Valdez Restoration Office

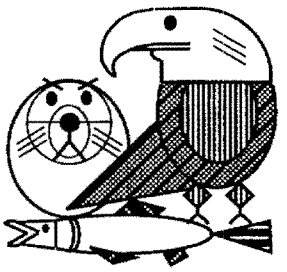
Date: October 14, 1994

Subj: Start Time for November 2 Trustee Council Meeting

We are trying to nail down a start time for the November 2, 1994, Trustee Council meeting in Anchorage. For those flying in from Juneau, is there a problem with taking the 6:35 a.m. flight? That would allow folks to arrive at the Simpson Building by 9:00 a.m. (barring any unforeseen delays). Cathy, is Mr. Frampton flying into Anchorage on November 1? Would a 9:00 a.m. start work with his schedule? Could you each call me (265-9326 desk or 278-8012) and let me know how this works for your respective TC members? Thank you!

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



FAX COVER SHEET

To: See distribution nxt pg Number: _____

From: Rebecca Williams Date: 10/14/94 9:15a.

Comments: Total Pages: 2

PLS forward to the individuals listed on the next pg. Thank you!!

Document Sent By: Rebecca

9/9/94

****
*** MULTI TRANSACTION REPORT ***
****

TX/RX NO. 3065

INCOMPLETE TX/RX	[31] 19074655070	J.SANDOR
TRANSACTION OK	[09] 19075867589	J.AYERS
	[25] 19075867840	P.JANIK
	[26] 19074652075	B.BOTELHO
	[27] 12022084684	G.FRAMPTON
	[28] 19075867249	S.PENNOYER
	[29] 19074652332	C.ROSIER
	[36] 2787022	ALEX-CRAIG
ERROR		

****
*** ACTIVITY REPORT ***
****

TRANSMISSION OK

TX/RX NO.	3065
CONNECTION TEL	19074655070
CONNECTION ID	J.SANDOR
START TIME	10/14 09:58
USAGE TIME	01'17
PAGES	2
RESULT	OK

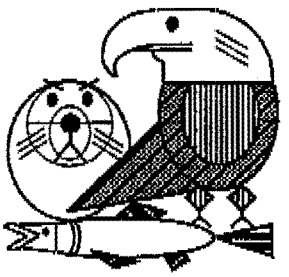
****
*** ERROR TX REPORT ***
****

TX FUNCTION WAS NOT COMPLETED

TX/RX NO.	3065
CONNECTION TEL	19074655070
CONNECTION ID	J.SANDOR
START TIME	10/14 09:31
USAGE TIME	00'00
PAGES	0
RESULT	NG 0 #018

resending
fy

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



FAX COVER SHEET

To: See distribution nxt pg Number:

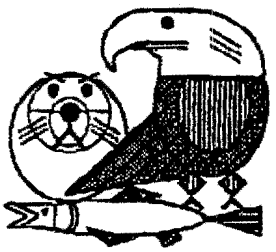
From: Rebecca Williams Date: 10/14/94

Comments: Total Pages: 2

PLS forward to the individuals listed on the next pg. Thank You!!

Rebecca -

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



MEMORANDUM

To: Cathy @ G. Frampton's Office
Rence @ P. Janik's Office
Linda @ S. Pennoyer's Office
Carla @ C. Rosier's Office
from Martha @ J. Sandor's Office
Vicki @ C. Tillery's Office
Wanda @ D. Williams' Office

From: Rebecca Williams RWW
Exxon Valdez Restoration Office

Date: October 14, 1994

Subj: Start Time for November 2 Trustee Council Meeting

We are trying to nail down a start time for the November 2, 1994, Trustee Council meeting in Anchorage. For those flying in from Juneau, is there a problem with taking the 6:35 a.m. flight? That would allow folks to arrive at the Simpson Building by 9:00 a.m. (barring any unforeseen delays). Cathy, is Mr. Frampton flying into Anchorage on November 1? Would a 9:00 a.m. start work with his schedule? Could you each call me (265-9326 desk or 278-8012) and let me know how this works for your respective TC members? Thank you!

fine for Sandor.

****
*** ACTIVITY REPORT ***
****

TRANSMISSION OK

TX/RX NO.	3068
CONNECTION TEL	19075867589
CONNECTION ID	J.AYERS
START TIME	10/14 10:22
USAGE TIME	00'49
PAGES	2
RESULT	OK

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 "G" Street, Anchorage, AK 99501
Phone: (907) 278-8012 Fax: (907) 276-7178

MEMORANDUM

TO: Restoration Work Force

FROM: Traci Cramer
Traci Cramer
Administrative Officer

DATE: October 12, 1994

RE: FFY95 Budget Corrections

In preparation for the Trustees meeting in November, I have reviewed the project detail that was submitted. Attachment A is a listing of technical amendments to the project detail since publication in the supplemental volume III. Corrections include making the titles consistent with the summary or changing the header from 1994 to 1995. The list is provided for information only, no action is required of the work force.

The following is a listing of substantive revisions that have been made since publication of the supplemental volume III. **Please confirm that the changes are consistent with what each agency requested or that the change is consistent with the Executive Director's Interim Budget Recommendations.** Additionally, I have underlined any unresolved questions. Any changes/additions and answers to the questions should be returned to me by **Friday, October 14th.**

No.	Title	Change
95009 C	Trophic Dynamics and Energy Flow: Impacts of Herring Spawn and Sea Otter Predation on Nearshore Benthic Community Structure	Budget detail submitted by the Forest Service. Total request $217.3.
95009 D	Survey and Experimental Enhancement of Octopuses in Intertidal Habitats	Budget detail submitted by the Forest Service. Total request $188.9.

95013	Killer Whale Recovery Monitoring in PWS	Used 4A to document contractual relationship with North Gulf Oceanic Society. NOAA submitted a revision to increase contractual personnel by $4.8 and decrease contractual administrative costs $9.5. Total decreased $6.1. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95014	Predation by Killer Whales in PWS: Feeding Behavior and Distribution of Predators and Prey	Used 4A to document contractual relationship with North Gulf Oceanic Society. Total decrease $3.9. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95024	Enhancement of Wild Pink Salmon Stocks	Per Executive Director's recommendation all of the costs have been moved to the remaining costs column. No change in total.
95044	In Situ Formation and and Ecotoxicity of Hydrocarbon	Used 4A to document contractual relationship with the Institute of Marine Science, UAF. Total decrease $2.6. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95057	Movement of Larval and Juvenile Fish	Used 4A to document contractual relationship with Institute of Marine Science, UAF and corrected a math error in commodities of $4.5. Total decrease $3.7. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95

		column.
95058	Restoration Assistance to Private Landowners	Costs reflected in the interim column, but no approval received. Is the budget being revised? The form has not been adjusted.
95064	Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in PWS	ADFG had inquired about the possibility of increasing the FFY95 request by $24.0 to cover ARGOS costs. Is the increase still required? The form has not been adjusted. Not needed Jerome
95069	Restoration of Salmon Stocks of Special Importance to Native Cultures	Per Executive Director's recommendation all of the costs has been moved to the remaining column. No change in total.
95100	Administration, Public Information & Scientific Management	The following adjustments have been made; 1) Chief Scientist, ADNR was increased $6.5 in the personnel line; 2) Operations, ADNR was increased $28.0 in the personnel line; and 3) Restoration Work Force, USFS was increased $21.5 in the personnel line, $5.5 in the travel line and decreased $1.0 in the commodities line. Total increase $68.9.
95115	Sound Waste Management	Agency requested an increase of $36.9.
95116	Restoration of Intertidal Oiled Mussel Beds by Non-destructive Manipulation/ Flushing with PES-51	No project description. Is the budget being revised?
95117-BAA	Harbor Seals and EVOS: Blubber and Lipids as Indices of Food Limitation	Used 4A to document contractual relationship with Institute of Marine Science, UAF. Total decrease $.2. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95118-BAA	Diet Composition, Reproductive Energetics and Productivity of Seabirds	Used 4A to document contractual relationship with Cooperative Fish and Wildlife Research Unit, UAF. Total

	Damaged by the Exxon Valdez Oil Spill	increase $1.0. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95120-BAA	Proximate Composition and Energetic Content of Select Forage Fish Species in PWS	Used 4A to document contractual relationship with Texas A&M University. Total increase $.1. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95121	Stable Isotope Ratios and Fatty Acid Signatures of Select Forage Fish Species in PWS	Used 4A to document contractual relationship with Texas A&M University. Total increase $.3. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95131	Clam Restoration (Nanwalek, Port Graham, Tatitlek)	Executive Director's recommendation indicated that the project should be rewritten as a pilot. <u>New documentation has not been received.</u> Jerome Coming
95139 D	Salmon Instream and Stock Restoration - Pink Creek and Horse Marine Barrier Bypass	Per Executive Director's recommendation all of the costs have been moved to the remaining cost column. No change in total costs.
95163	Abundance and Distribution of Forage Fish and their Influence on Recovery on Injured Species	NOAA consolidated the trips from Juneau to Anchorage into one entry. No change in total costs.

95165	Carry-forward: PWS Herring Genetic Stock Identification	ADFG has requested that the FFY95 remaining costs be increased to reflect the carry-forward of $36.2 from FFY94. The budget has been changed as requested.
95279	Subsistence Restoration Project	NOAA has requested an increase of $34.1 to the interim budget. Personnel costs would increase $20.0; Contractual would increase $1.0; Supplies would increase $10.0; and the GA would increase $3.1.
95320 E	Juvenile Salmon and Herring Integration	Per Executive Director's recommendation $16.0 for the skiff and motor has been transferred to the remaining costs column. No change in total costs.
95320 J	Information Systems and Model Development	Per Executive Director's recommendation $80.3 for the Rosentiel contract has been transferred to the remaining costs column. No change in total costs.
		Additionally, ADFG has requested that the FFY95 remaining costs be increased to reflect the carry-forward of $25.0 from FFY94. The budget has been changed as requested.
		I have also deleted duplicate ADFG pages.
95320 M	Observational Physical Oceanography in PWS and the Gulf of Alaska	ADFG has requested that the FFY95 remaining costs be increased to reflect the carry-forward of $20.0 from FFY94. The budget has been changed as requested.
95320 S	Disease Impacts on PWS Herring Populations (competitive solicitation under State of Alaska two-step RFQ-RFP process)	ADFG has requested that the FFY95 remaining costs be increased $126.5 for report writing expenses that were inadvertently overlooked in the original submission. The budget has been changed as requested.
95424	Restoration Reserve	Budget detail has been created.

OK 10/17
Not needed
UA-ESA
UA-ESA

This memorandum represents a summary of changes that have been made since publication of the supplemental volume III, and not confirmation that the proposed changes have been approved.

Call if you have any questions, or would like copies of the changed documents.

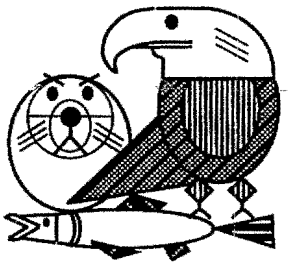
attachment

ATTACHMENT A - Technical Corrections

Project No.	Title Correction	Changed Year
95001	x	
95007B	x	
95018	x	
95019	x	x
95021	x	x
95022	x	x
95023	x	x
95024	x	
95025A	x	
95025B	x	x
95025C	x	x
95025D	x	x
95025E	x	x
95025F	x	x
95025G		x
95025H	x	x
95026	x	
95027	x	
95029	x	
95030	x	
95031	x	
95041	x	
95043A	x	
95043B	x	
95048	x	
95051	x	
95052	x	
95055	x	
95060	x	
95064	x	
95065		x
95075	x	
95076	x	
95086-C	x	
95087	x	
95090	x	
95092	x	
95110-CLO	x	
95111		x
95116	x	
95122	x	
95131	x	

Project No.	Title Correction	Changed Year
95139A1	x	
95139A2	x	
95139B	x	
95139C1	x	
95139C2	x	
95139D	x	
95165	x	
95199-CLO	x	
95244	x	
95259	x	
95266	x	
95279	x	
95285-CLO	x	
95320A	x	
95320B	x	
95320C	x	
95320D	x	
95320H	x	
95320I(1)	x	
95320I(2)	x	
95320J	x	
95320M	x	
95320Q	x	
95320S	x	
95320T	x	
95320U	x	
95320Y	x	
95417	x	
95422-CLO	x	
95428-CLO	x	
95505B	x	

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



MEMORANDUM

TO: Ms. Kate Fenton

FROM: Eric F. Myers, Project Coordinator

DATE: October 11, 1994

SUBJ: Memorandum of Agreement and Consent Decree

Joe Sullivan asked that I send you a copy of the attached Memorandum of Agreement and Consent Decree.

If I can be of further assistance, please let me know.

enclosure

cc: Joe Sullivan

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 "G" Street, Anchorage, AK 99501
Phone: (907) 278-8012 Fax: (907) 276-7178

MEMORANDUM

TO: Restoration Work Force

FROM: Traci Cramer
Traci Cramer
Administrative Officer

DATE: October 12, 1994

RE: FFY95 Budget Corrections

In preparation for the Trustees meeting in November, I have reviewed the project detail that was submitted. Attachment A is a listing of technical amendments to the project detail since publication in the supplemental volume III. Corrections include making the titles consistent with the summary or changing the header from 1994 to 1995. The list is provided for information only, no action is required of the work force.

The following is a listing of substantive revisions that have been made since publication of the supplemental volume III. **Please confirm that the changes are consistent with what each agency requested or that the change is consistent with the Executive Director's Interim Budget Recommendations.** Additionally, I have underlined any unresolved questions. Any changes/additions and answers to the questions should be returned to me by **Friday, October 14th.**

No.	Title	Change
95009 C	Trophic Dynamics and Energy Flow: Impacts of Herring Spawn and Sea Otter Predation on Nearshore Benthic Community Structure	Budget detail submitted by the Forest Service. Total request $217.3.
95009 D	Survey and Experimental Enhancement of Octopuses in Intertidal Habitats	Budget detail submitted by the Forest Service. Total request $188.9.

95013	Killer Whale Recovery Monitoring in PWS	Used 4A to document contractual relationship with North Gulf Oceanic Society. NOAA submitted a revision to increase contractual personnel by $4.8 and decrease contractual administrative costs $9.5. Total decreased $6.1. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95014	Predation by Killer Whales in PWS: Feeding Behavior and Distribution of Predators and Prey	Used 4A to document contractual relationship with North Gulf Oceanic Society. Total decrease $3.9. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95024	Enhancement of Wild Pink Salmon Stocks	Per Executive Director's recommendation all of the costs have been moved to the remaining costs column. No change in total.
95044	In Situ Formation and and Ecotoxicity of Hydrocarbon	Used 4A to document contractual relationship with the Institute of Marine Science, UAF. Total decrease $2.6. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95057	Movement of Larval and Juvenile Fish	Used 4A to document contractual relationship with Institute of Marine Science, UAF and corrected a math error in commodities of $4.5. Total decrease $3.7. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95

		column.
95058	Restoration Assistance to Private Landowners	Costs reflected in the interim column, but no approval received. Is the budget being revised? The form has not been adjusted.
95064	Monitoring, Habitat Use, and Trophic Interactions of Harbor Seals in PWS	ADFG had inquired about the possibility of increasing the FFY95 request by $24.0 to cover ARGOS costs. Is the increase still required? The form has not been adjusted.
95069	Restoration of Salmon Stocks of Special Importance to Native Cultures	Per Executive Director's recommendation all of the costs has been moved to the remaining column. No change in total.
95100	Administration, Public Information & Scientific Management	The following adjustments have been made; 1) Chief Scientist, ADNR was increased $6.5 in the personnel line; 2) Operations, ADNR was increased $28.0 in the personnel line; and 3) Restoration Work Force, USFS was increased $21.5 in the personnel line, $5.5 in the travel line and decreased $1.0 in the commodities line. Total increase $68.9.
95115	Sound Waste Management	Agency requested an increase of $36.9.
95116	Restoration of Intertidal Oiled Mussel Beds by Non-destructive Manipulation/ Flushing with PES-51	No project description. Is the budget being revised?
95117-BAA	Harbor Seals and EVOS: Blubber and Lipids as Indices of Food Limitation	Used 4A to document contractual relationship with Institute of Marine Science, UAF. Total decrease $.2. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95118-BAA	Diet Composition, Reproductive Energetics and Productivity of Seabirds	Used 4A to document contractual relationship with Cooperative Fish and Wildlife Research Unit, UAF. Total

	Damaged by the Exxon Valdez Oil Spill	increase $1.0. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95120-BAA	Proximate Composition and Energetic Content of Select Forage Fish Species in PWS	Used 4A to document contractual relationship with Texas A&M University. Total increase $.1. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95121	Stable Isotope Ratios and Fatty Acid Signatures of Select Forage Fish Species in PWS	Used 4A to document contractual relationship with Texas A&M University. Total increase $.3. Additionally, the form was adjusted to make the remaining cost column consistent with the Total FFY95 column.
95131	Clam Restoration (Nanwalek, Port Graham, Tatitlek)	Executive Director's recommendation indicated that the project should be rewritten as a pilot. <u>New documentation has not been received.</u>
95139 D	Salmon Instream and Stock Restoration - Pink Creek and Horse Marine Barrier Bypass	Per Executive Director's recommendation all of the costs have been moved to the remaining cost column. No change in total costs.
95163	Abundance and Distribution of Forage Fish and their Influence on Recovery on Injured Species	NOAA consolidated the trips from Juneau to Anchorage into one entry. No change in total costs.

95165	Carry-forward: PWS Herring Genetic Stock Identification	ADFG has requested that the FFY95 remaining costs be increased to reflect the carry-forward of $36.2 from FFY94. The budget has been changed as requested.
95279	Subsistence Restoration Project	NOAA has requested an increase of $34.1 to the interim budget. Personnel costs would increase $20.0; Contractual would increase $1.0; Supplies would increase $10.0; and the GA would increase $3.1.
95320 E	Juvenile Salmon and Herring Integration	Per Executive Director's recommendation $16.0 for the skiff and motor has been transferred to the remaining costs column. No change in total costs.
95320 J	Information Systems and Model Development	Per Executive Director's recommendation $80.3 for the Rosentiel contract has been transferred to the remaining costs column. No change in total costs. Additionally, ADFG has requested that the FFY95 remaining costs be increased to reflect the carry-forward of $25.0 from FFY94. The budget has been changed as requested. I have also deleted duplicate ADFG pages.
95320 M	Observational Physical Oceanography in PWS and the Gulf of Alaska	ADFG has requested that the FFY95 remaining costs be increased to reflect the carry-forward of $20.0 from FFY94. The budget has been changed as requested.
95320 S	Disease Impacts on PWS Herring Populations (competitive solicitation under State of Alaska two-step RFQ-RFP process)	ADFG has requested that the FFY95 remaining costs be increased $126.5 for report writing expenses that were inadvertently overlooked in the original submission. The budget has been changed as requested.
95424	Restoration Reserve	Budget detail has been created.

This memorandum represents a summary of changes that have been made since publication of the supplemental volume III, and not confirmation that the proposed changes have been approved.

Call if you have any questions, or would like copies of the changed documents.

attachment

ATTACHMENT A - Technical Corrections

Project No.	Title Correction	Changed Year
95001	x	
95007B	x	
95018	x	
95019	x	x
95021	x	x
95022	x	x
95023	x	x
95024	x	
95025A	x	
95025B	x	x
95025C	x	x
95025D	x	x
95025E	x	x
95025F	x	x
95025G		x
95025H	x	x
95026	x	
95027	x	
95029	x	
95030	x	
95031	x	
95041	x	
95043A	x	
95043B	x	
95048	x	
95051	x	
95052	x	
95055	x	
95060	x	
95064	x	
95065		x
95075	x	
95076	x	
95086-C	x	
95087	x	
95090	x	
95092	x	
95110-CLO	x	
95111		x
95116	x	
95122	x	
95131	x	

Project No.	Title Correction	Changed Year
95139A1	x	
95139A2	x	
95139B	x	
95139C1	x	
95139C2	x	
95139D	x	
95165	x	
95199-CLO	x	
95244	x	
95259	x	
95266	x	
95279	x	
95285-CLO	x	
95320A	x	
95320B	x	
95320C	x	
95320D	x	
95320H	x	
95320I(1)	x	
95320I(2)	x	
95320J	x	
95320M	x	
95320Q	x	
95320S	x	
95320T	x	
95320U	x	
95320Y	x	
95417	x	
95422-CLO	x	
95428-CLO	x	
95505B	x	

REBECCA
- READING FILE

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 "G" Street, Anchorage, AK 99501
Phone: (907) 278-8012 Fax: (907) 276-7178

FAX COVER SHEET

TO: Restoration Work Force	FROM: Terri
OFFICE:	OFFICE: Executive Director's Office
FAX NUMBER:	FAX NUMBER: 586-7589
PHONE NUMBER:	PHONE NUMBER: 586-7238

COMMENTS:

DATE:	TOTAL PAGES: 9 w/cover

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 "G" Street, Anchorage, AK 99501
Phone: (907) 278-8012 Fax: (907) 276-7178

MEMORANDUM

TO: Marlyn Carrillo, Administrative Assistant
Division of Administrative Services
Department of Fish & Game

FROM: Mary Rivera, Administrative Assistant
Executive Director's Office, EVOS

DATE: October 10, 1994

RE: Business Travel Account

This is to update the list of traveler's using the *Exxon Valdez* Oil Spill Trustee Council Business Travel Account. The following individuals may use the account:

James R. Ayers, Executive Director
Molly McCammon, Director of Operations
Traci Cramer, Director of Administration
Eric Myers, Project Coordinator
L.J. Evans, Public Information Officer
Ward Lane, Analyst Programmer
Mary Rivera, Administrative Assistant

If you have any questions, please call me at 586-7238.

mir

cc: Alaska Travel Service (via fax)

C:\WPDOCS\BTAUPDTE.MEM

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 "G" Street, Anchorage, AK 99501
Phone: (907) 278-8012 Fax: (907) 276-7178

October 7, 1994

Ms. Donna Platt
President
The Eyak Corporation
P.O. Box 340
Cordova, AK 99574

Mr. Luke Borer
President
Sherstone, Inc.
P.O. Box 340
Cordova, AK 99574

Dear Ms. Platt and Mr. Borer:

Thank you for your letter of October 4, 1994, clarifying a number of issues relative to your May 24, 1994, Eyak and Sherstone comprehensive proposal.

The Trustee Council has reviewed your comments and has authorized me to respond and proceed with negotiations on the following basis.

The Trustee Council has a fiduciary responsibility to the public to use restoration funds to cost-effectively restore injured resources and services. The Council has previously determined that your May 24 proposal does not provide adequate assurance of long-term habitat protection necessary for restoration. They cannot in good faith accept your May 24 proposal. Instead, they have requested me to work with you to develop a proposal that meets restoration needs.

I firmly believe that, together, we can develop a proposal which provides the Trustee Council with legal assurance of long-term habitat protection necessary for restoration in areas acquired while providing Eyak and Sherstone the flexibility to meet other corporate and shareholder objectives.

The Trustees are hopeful that a proposal can be developed before the next Trustee Council meeting on November 2 and 3. Given the limited time available, I propose concentrating on the development of a proposal for Trustee Council and Eyak consideration limited to the "revised" Orca Narrows parcel and the Core lands. This approach would substantially reduce both the number and scope of the complexities inherent in your May 24, 1994 proposal. This will allow

us to move forward with habitat protection that will aid restoration of injured resources and services while meeting the objectives of Eyak.

I sincerely hope that you and the Board's of the Eyak and Sherstone Corporations will give these suggestions serious and favorable consideration and that a proposal can be developed prior to the November 2 and 3 meeting.

Sincerely,

James R. Ayers
Executive Director

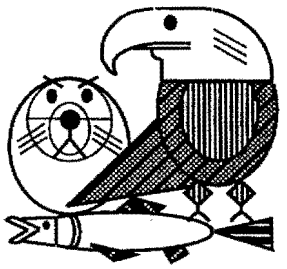
JRA/mir

cc: Trustee Council Members

C:\WPDOCS\EYAKSHER.LTR

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



MEMORANDUM

TO: Agency Liaisons
Restoration Workforce
Trustee Council Staff

FROM: Molly McCammon
Director of Operations

DATE: October 3, 1994

SUBJ: **Public Comment Dedicated Phone Line**

The Trustee Council policy has always been to accept comments verbally when a member of the public wishes to express his or her opinion in that fashion. It is especially important to accommodate this need because the member of the public may be unable to provide comments in writing due to a disability. However, at times in the past when no one was available to write down verbal comments, it has been difficult to meet this need.

Effective Monday, October 31, we have dedicated a voice mail box to serve as a public comment line. The public comment voice mail box is to be used if a member of the public wishes to deliver a verbal comment but no one is available to take the call. Staff will monitor the voice mail box and write down comments to forward to the appropriate individual, work group or the Trustees.

It is always preferable to forward the call to a designated person in the relevant working group to accept these verbal comments "live," but the public comment line will assist us in accepting these comments when a designated person is not available. It is important for staff to use the public comment line as a last resort, and to interact "live" with the people who call as often as possible.

The direct number for the public comment line is 907/265-9324. If calling from within the Simpson Building, use extension 224.

APPLIED
marine
SCIENCES

October 3, 1994

TO: Stan Senner
Chris Haney
Alan Springer

FROM: Andy Gunther

CC: Bob Spies

RE: Peer review of revised Forage Fish Proposal

Enclosed you will find the revised forage fish package for peer review. Please note that due to my need to be at the SEA program review in Cordova, I am actually writing this letter before I have seen the new package, the title of which I believe will be "Marine Bird Forage Fish Interactions." The package will be delivered to you directly from Anchorage.

I have also enclosed a copy of the Chief Scientist's recommendation to the Executive Director related to the "forage fish" Brief Project Descriptions that we reviewed in July. Please consider issues raised in this memo in the course of your review, in addition to any other items that are of concern to you. I would also welcome any thoughts you have regarding the proposed cost of the project.

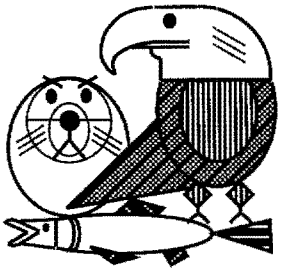
Please consider two addition points. First, what is the appropriate way for this package to utilize previous research conducted in the Gulf of Alaska, and are there reasons for this project be expanded into the Gulf? Second, I am becoming increasingly concerned that hydrographic features (fronts, tidal rips, local currents) play a critical role in determining the temporal and spatial distribution of marine bird foraging in the Sound. If this is true, what is the appropriate strategy to ensure that hydroacoustic sampling sites are representative of bird foraging areas?

As we discussed on the phone, I expect written comments faxed to my office by October 12th, as I'm going to have to turn all this around very quickly to provide a revised recommendation to the Executive Director by the 15th. I will be in Anchorage at the Restoration Office on Friday, October 7, and back in my office on Monday the 10th. Thank you for agreeing to review this package so promptly.

2155 Las Positas Court, Suite S Livermore, CA 94550 510.373.7142 FAX 510.373.7834

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



TO: Project Reviewers

FROM: Molly McCammon
Director of Operations

SUBJECT: Revised Proposals

DATE: October 6, 1994

Enclosed you will find a revised package of Brief Project Descriptions for Forage Fish/Marine Bird Interactions: Project 95163.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. Tudor Rd.
Anchorage, Alaska 99503-6199

IN REPLY REFER TO:

James R. Ayers, Executive Director
Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 G Street
Suite 401
Anchorage, Alaska 99501-3451

OCT 5 1994

Dear Mr. Ayers:

Thank you for your recommendations regarding the scope and scale of forage fish investigations for FY 95 in your September 7, 1994 letter. As planned, a forage fish work session was held in Anchorage on September 19-20 and another work session was held September 26-27. Through a combination of these meetings, the comments from the chief scientist, and much work, we have developed a Seabird/Forage Fish package for FY95 and are now functioning as a team rather than several independent projects. The cover proposal and the brief project descriptions for each subproject are attached.

We have tried to be responsive to the chief scientist's comments, and to that end, we reduced the project budget from about $2.4 million to about $1.4 million. However, reducing the budget caused a reduction in the scope of work. We reduced the area of the Forage Fish Assessment (95163A) component from all of Prince William Sound to a portion of the Sound, and we reduced the field season from April through September to just July and August. We also deleted the assessment of demersal fish in the Pigeon Guillemot (95163F) component. The Puffin component (95163D) was reduced to a minimal feasibility study.

If more funds are available, an additional cruise for the Forage Fish Assessment component would provide valuable data for the seabird pre-laying period. For about an additional $100K (a 25% increase) the total amount of data collected could be increased 50%, because of fixed costs associated with the project that would not increase.

Below we have addressed the chief scientist's comments on the Seabird/Forage Fish project. Brief project descriptions for each subproject have been modified to respond to comments specific to the subprojects.

Program Management and Integration

We agree with the chief scientist's comments that projects addressing food limitation need to be carefully coordinated. In our recent work sessions, we have made great strides in coordination among the Seabird/Forage Fish project components and we will continue to work out details throughout the winter with monthly coordination meetings. All the Principal Investigators of the subprojects recognize that complete integration is a necessity to put forth a comprehensive, efficient research effort to address food limitation questions that involve multiple trophic levels. In the cover proposal we have outlined the sharing of data and logistical support among projects; details on the specific needs of each project will be addressed in our monthly coordination meetings. We will also discuss contingency planning for integral parts of the package and outline alternatives.

Quality assurance will be accomplished in many ways. All detailed project descriptions will be reviewed by all Principal Investigators, by the proposed Seabird/Forage Fish project Technical Steering Committee, and by the Trustee Council Interim Review Board. Annual reports, including the synthesis report, will go through the same review process. A biometrician will be contracted to review sampling designs and data analyses. Interim progress will be tracked by review of overall progress at the annual January Science Workshop and by review of the annual subproject reports and annual synthesis report.

The Principal Investigators for each subproject of the Seabird/Forage Fish project have appointed us (David Irons and Bruce Wright) as Interim Project Coordinators for this project. We plan to take on the program management tasks outlined in the subproject brief project description (95163I), including but not limited to, coordination within and among projects to maximize data and logistics sharing, facilitating communications with the oil spill restoration office, and scheduling performance milestones and ensuring they are met. We plan to hire a Project Coordinator midway through FY95 to assume these important tasks, and we are committed to identifying an individual who is acceptable to all Principal Investigators and can work effectively with their counterparts in SEA, Nearshore Vertebrate Predators, and other relevant EVOS projects.

Coordination between the Seabird/Forage Fish project and other projects has already begun. Dr. Irons contacted Dr. Cooney of the SEA package and set up the first coordination meeting for mid October, which will result in a list of issues and a schedule of coordination meetings. Dr. Cooney was very interested and positive about coordination of the two packages. Dr. Cooney and Dr. Irons are confident that the two packages can be coordinated to ensure efficiency in the Exxon Valdez Trustee Council Work Plan. A coordination plan with the Nearshore Vertebrate Predator project, other marine bird projects, and the information management projects will be set up in October. All data that are collected by the Seabird/Forage Fish project will be available to the SEA and the Trustee Council data base management systems.

Research Program Design

We agree with the chief scientist's recommendation to focus on pigeon guillemots and black-legged kittiwakes initially. Because puffins offer a potential cost-saving method of sampling forage fish, we propose to conduct a small feasibility study in the core sampling area around Naked and Smith Islands to determine if those puffin colonies are accessible for use.

Regarding the Pigeon Guillemot project (old number 94173, new number 95163F), past studies have shown that guillemots appear to prefer sand lance, a schooling fish, over demersal fish, and some evidence suggests their reproductive success tends to be higher when they feed on sand lance compared to demersal fish. In the late 1970's guillemots at Naked Island ate many sand lance, but in 1994 birds at Naked Island ate few sand lance or other schooling fish and many demersal fish, while birds at Jackpot Island ate many schooling fish (i.e., herring and smelt but not sand lance). We feel it is important to assess the abundance and species composition of demersal fish as well as that of schooling fish. However, considering the larger question of food limitation for several species, the assessment of demersal fish is less important than assessment of schooling fish. To try to meet the budget recommended by the chief scientist, we removed the work relating to the assessment of demersal fish from the FY95 Pigeon Guillemot proposal.

We agree with the chief scientist that hydroacoustic surveys and net sampling provide data on only the relative abundance and distribution of forage fish and we recognize that forage fish might be present but unavailable to birds. There are three subprojects that will provide data to determine the availability of forage fish to birds. The Forage Fish Assessment/Birds component will collect bird distribution and behavior data simultaneously with hydroacoustic surveys. These data will provide information on two aspects of fish availability: depth of fish schools and distance from bird colonies to fish. The Kittiwake and Pigeon Guillemot components will provide data on foraging ranges from colonies, diets of birds, and habitats used by foraging birds. After data from 1994 are analyzed, we will know if the Forage Fish Assessment component is sufficiently sampling habitat used by foraging seabirds. If it is not, the sampling design will be restratified to sample more in areas used by birds.

Integration with SEA (95320)

Regarding integration with the SEA project, as mentioned earlier, Dr. Cooney and Dr. Irons discussed the importance of coordinating the two projects and planned a meeting in mid October to discuss coordination and plan future meetings. The principal investigators of both projects are aware of the necessity of good coordination. As the chief scientist pointed out, it is essential that the hydroacoustic data from both projects be compatible to maximize the coverage of data on distribution, abundance, and composition of forage fish (which include juvenile herring and salmon) in Prince William Sound. All other opportunities to collaborate and share data or logistics will be explored. All data collected by the Seabird/Forage Fish project will be made available to the SEA database.

We feel that we are well on the way to developing an efficient, comprehensive, integrated research effort that will provide valuable information on the question of whether food is limiting the recovery of injured resources.

Bruce Wright and I coordinated closely in writing this letter, but he was unable to be present to sign it.

Sincerely,

David B. Irons

Co-Project Coordinator

Seabird/Forage Fish

Project Number:	95163A-I
Restoration Category:	Research (new)
Proposed By:	DOI, NOAA, ADFG
Cost FY 95:	$1,446K (includes write-up of 1995 report)
Cost FY 96:	$2,400K (includes write-up of 1996 report)
Total Cost:	Unknown
Duration:	5 years
Geographic area:	Prince William Sound
Injured Resource/Service:	Multiple resources

INTRODUCTION

Populations of several piscivorous marine bird and mammal species have declined in Prince William Sound (PWS) since 1972; conversely, species that feed on benthic invertebrates have not declined. Marbled murrelets, pigeon guillemots, arctic terns, black-legged kittiwakes, glaucous-winged gulls, tufted puffins, and harbor seals feed primarily on schooling forage fish and have declined by more than 50%. Harlequin ducks, goldeneyes, black oystercatchers, and sea otters feed on benthic invertebrates and have not declined throughout PWS, although some species were affected by the *Exxon Valdez* oil spill. This pattern of declines in piscivorous species and absence of declines in species consuming benthic invertebrates suggests that marked changes in the forage fish community abundance, distribution, and species composition occurred over the last 20 years. Sand lance was an important component of pigeon guillemot diets in the late 1970's that has virtually disappeared from their diets in the 1990's.

If populations of piscivorous seabirds that were injured by the *Exxon Valdez* oil spill (i.e., common murre, marbled murrelet, and pigeon guillemot) are currently limited by food, recovery of these populations is not likely. Therefore, an important hypothesis to be addressed by restoration research is that the recovery of injured species is limited by food. The goal of this study is to determine if the distribution, abundance, availability, and species composition of forage fish in PWS are limiting recovery of injured seabird populations.

Reproductive success of seabirds is largely dependent upon foraging constraints experienced by breeding adults. Previous studies of seabird reproductive energetics have indicated that

productivity is energy-limited. Forage fish vary considerably in energy density. Therefore, knowledge of energy content of prey provisioned to seabird nestlings is critical for understanding the effects of changes in the forage fish resources on the productivity of seabird populations.

To address questions about food limitation for seabirds, species must be studied for which productivity and parameters that indicate food stress can be measured. Surface-feeding species and diving species should each be studied because of differential ability to pursue prey. In PWS, kittiwakes (surface feeders) and pigeon guillmots (divers) are the two most appropriate species to study. Both species are widespread and the necessary data can be collected for them relatively easily.

Food limitation may have been the cause for recent low seabird productivity and consequent population declines in other parts of Alaska. Some black-legged kittiwake colonies in the Gulf of Alaska have declined over the past ten to fifteen years. There are indications that capelin, an important component of seabird diets in the 1970's, declined drastically in 1978 and has remained low. Kittiwakes and murres at some colonies in the Bering Sea have suffered chronically low productivity in the past 15 years and food supply has been implicated as the prime factor.

Investigations of the relationships between pelagic seabirds and their prey have been conducted in the Gulf of Alaska, the Bering Sea, the North Atlantic Ocean, and the Southern Ocean using counts of birds and associated hydroacoustic data. This work has been short-term and the general objective has been to understand the mechanisms (e.g., oceanographic features) that make prey available to seabirds. However, there have been multi-year studies in limited areas of the North Atlantic that compared relative abundance of forage fish to reproductive performance in seabirds. Relationships between some seabird foraging and reproductive parameters and forage fish relative abundance were found that indicated food was more limiting in some years than others.

Assessing the abundance and composition of seabird prey in a large area, such as the Gulf of Alaska or the Bering Sea, is a very complex, expensive, and difficult task. However, nesting tufted puffins have been used to sample species composition of the fish communities in selected areas of the northern Gulf of Alaska. This technique is potentially useful and inexpensive, but needs more ground truthing with independent data on fish composition before it can be substituted for shipboard net sampling.

NEED FOR THE PROJECT

The *Exxon Valdez* Oil Spill Trustee Council scientists identified the long-term declines in PWS piscivorous marine bird and mammal species as a high-priority ecosystem issue.

Several injured species were in decline before the oil spill and might not recover due to food limitation. Ecosystem processes are complex and involve multiple resources at several trophic levels. Therefore, restoration projects to address this issue must involve an integrated, collaborative, multi-disciplinary approach.

The Seabird/Forage Fish project has several interrelated components (Table 1) that together address the food limitation hypothesis. These components are ecologically and conceptually linked (Figure 1) and therefore must be conducted concurrently and collaboratively to achieve the project goals. Each subproject is dependent upon others for data and logistical support. The Forage Fish Assessment and Forage Fish Assessment/Birds components provide information on amount and quality of seabird prey available. The Puffin project might provide an inexpensive method to assess fish composition. The Seabird Energetics and Forage Fish Composition components provide information on the energetic constraints that prey availability and quality place on seabird productivity. The Pigeon Guillemot and Kittiwake components provide information on the extent of food stress and on reproductive success of seabirds. The Forage Fish Diets component investigates the overlap in diets between forage fish and juvenile salmon. Together, these components provide information on how the amount and quality of prey might limit seabird productivity and population recovery.

The Seabird/Forage Fish project will ensure that a comprehensive, cooperative, and efficient research effort is developed to collect information to address the food limitation hypothesis. This information is crucial for understanding the factors constraining recovery of marine birds and mammals damaged by the spill and for designing management initiatives to enhance productivity of species that are failing to recover.

PROJECT DESIGN

A. Objectives

To determine if the distribution, abundance, and species composition of forage fish are limiting recovery of injured seabird resources.

B. Methods

The Seabird/Forage Fish project comprises nine subprojects, the specific objectives and methods of which are outlined in the attached subproject descriptions.

C. Schedule

October 1994-May 1995	Prepare for field season Monthly coordination meetings of Principal Investigators Regularly scheduled coordination meetings with SEA and other projects
May-September 1995	Field work
October-December 1995	Data analysis
January 1996	Presentation at Science Workshop
31 January 1996	Draft annual reports due
February-March 1996	Reports reviewed by Technical Steering Committee, Trustee Core Reviewers, and other Principal Investigators
March 1996	Prepare Fy 96 Proposal
31 March 1996	Final annual reports due
May-September 1996	Field Work
30 June 1996	Draft annual synthesis report due
July-August 1996	Reports reviewed by Technical Steering Committee, Trustee Core Reviewers and other Principal Investigators
31 August 1996	Final annual synthesis report due

D. Technical Support

We plan to establish a Technical Steering Committee of three experts on seabird/forage fish interactions that will provide external review, advice, and guidance on the technical aspects of the overall project as well as on specific components.

Requirements for technical support for each component are identified in attached subproject descriptions.

E. Location

The focus of the study is in Prince William Sound (Figure 2) in 1995. In future years it is expected to expand into the northern Gulf of Alaska. Specific study sites are shown in Figure 2.

PROJECT IMPLEMENTATION

The Fish and Wildlife Service, National Biological Survey, National Marine Fisheries Service, Alaska Department of Fish and Game, University of Alaska, and Texas A&M University will collaborate on this project. Opportunities for public involvement in data collection and synthesis and review of reports are present in the subprojects. The responsibilities for

implementing this program were divided up based on expertise and prior experience with the methods, venues, and resources proposed for the research.

COORDINATION OF INTEGRATED RESEARCH EFFORT

There will be two major elements of coordination to ensure efficiency in this research program: coordination among the subprojects within the Seabird/Forage Fish project and coordination between the Seabird/Forage Fish project and other projects. Because of the links inherent in research involving multiple trophic levels, the components of the Seabird/Forage Fish project are highly dependent upon each other (Figure 3). The Forage Fish Diets component will provide information to the Forage Fish Assessment component on the dietary overlap among species, which will provide insight into possible competition. The Puffin component is linked with the Forage Fish Assessment component in that it might be another method of sampling forage fish; the Puffin study will also provide samples to the Seabird Energetics component. The Forage Fish Assessment component will provide data on fish distribution, abundance, and species composition to the Forage Fish Assessment/Birds, the Pigeon Guillemot, and the Kittiwake components. The Forage Fish Assessment/Birds component will provide data on foraging behavior in relation to fish distribution and abundance to the Pigeon Guillemot and Kittiwake components. The Pigeon Guillemot and Kittiwake components will share information on the distribution of foraging birds and will compare their data to those of the Forage Fish Assessment/Bird component. Also, much data will be shared between the Seabird Energetics component and the Pigeon Guillemot and Kittiwake components. The Forage Fish Composition component will provide data to the Seabird Energetics component.

Logistics will be coordinated to minimize cost and maximize data collection through the program management and integration process and regular meetings among the Principal Investigators. The Forage Fish Assessment component will provide logistical support for the Forage Fish Assessment/Birds component. The Pigeon Guillemot, Kittiwake, Puffin, and Seabird Energetics components will share field camps and logistical support where practical.

The Seabird/Forage Fish project will coordinate with several other projects in PWS to increase the overall efficiency of the *Exxon Valdez* Trustee Council work plan (Figure 4). Coordination with the SEA study is imperative to maximize sharing of data and logistical support. All data collected by the Seabird/Forage Fish project will be available to the data base management system that is maintained by the SEA program (95320J) and to the oil spill office information management system (95089). Data collected on forage fish distribution, abundance, composition, and energy content will be provided to the marine mammal studies and other marine bird projects. The Nearshore Vertebrate Predators project will collect information on ecosystem health using bioindicators, which will provide valuable information on the level of toxins that might affect seabirds.

The program coordinator for the Seabird/Forage Fish project will ensure that coordination within the project and between this and other projects occurs, facilitate communication with the oil spill restoration office, ensure that performance milestones are met, prepare annual synthesis presentations and reports, and explore opportunities for data management and systems modelling in cooperation with SEA project (95320J) and Project 95089.

FY 95 BUDGET ($K)

See Table 1 for a list of subproject budget totals and attached subproject descriptions for budgets of each subproject.

Table 1. List of subprojects in the Marine Bird/Forage Fish project (95163A-I) and their budgets.

New Number	Old Number	Subproject Name	Proposed Budget($K)	Revised Budget($K)
95163 A	95163	Forage Fish Assessment	842	483
95163 B	95163	Forage Fish Assessment/Birds	221	155
96163 C	95163	Forage Fish Diets	258	77
95163 D	95019	Puffins as Samplers	271	32
95163 E	95033	Kittiwakes as Indicators	199	180
95163 F	95173	Pigeon Guillemot Recovery	409	260
95163 G	BAA-118	Seabird Energetics	141	141
95163 H	BAA-120	Energy Composition of Fish	43	43
95163 I	-	Program Management and Integration	-	75
		TOTAL	$2,384K	$1,446K

Table 2. Matrix of temporal data needs for abundance, distribution, and species composition of forage fish by subproject and proposed cruise dates.

	April	May	June	July	August	September
Pigeon Guillemot Recovery				----------		
Kittiwakes as Indicaters	----------	----------	----------	----------	----------	
Puffins as Samplers					----------	
Seabird Energetics				----------		
Proposed Cruises				----------	----------	

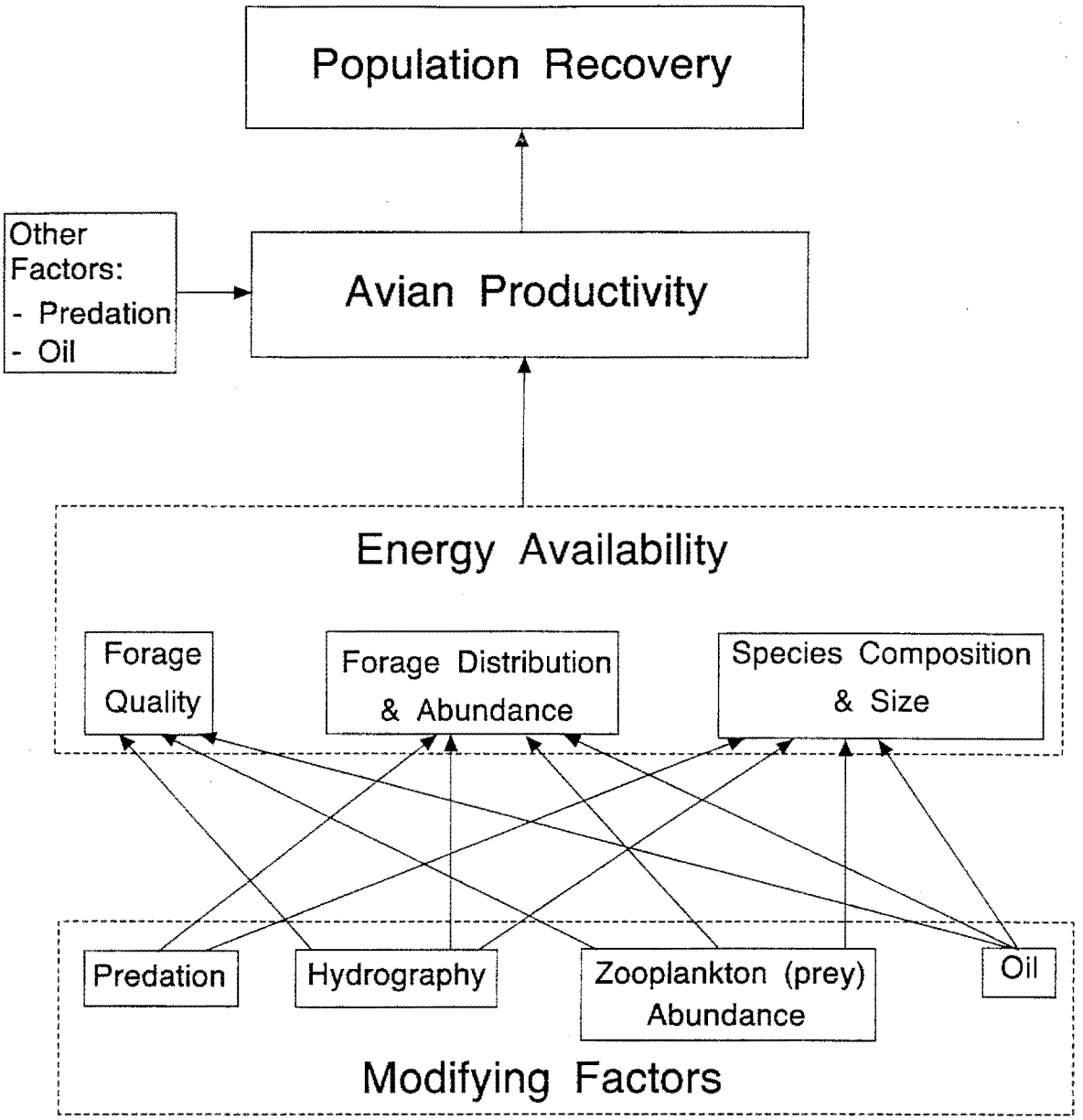


Figure 1. Conceptual framework for the Seabird/Forage Fish project (95163A-I) showing ecological links to factors that may control avian productivity and recovery.

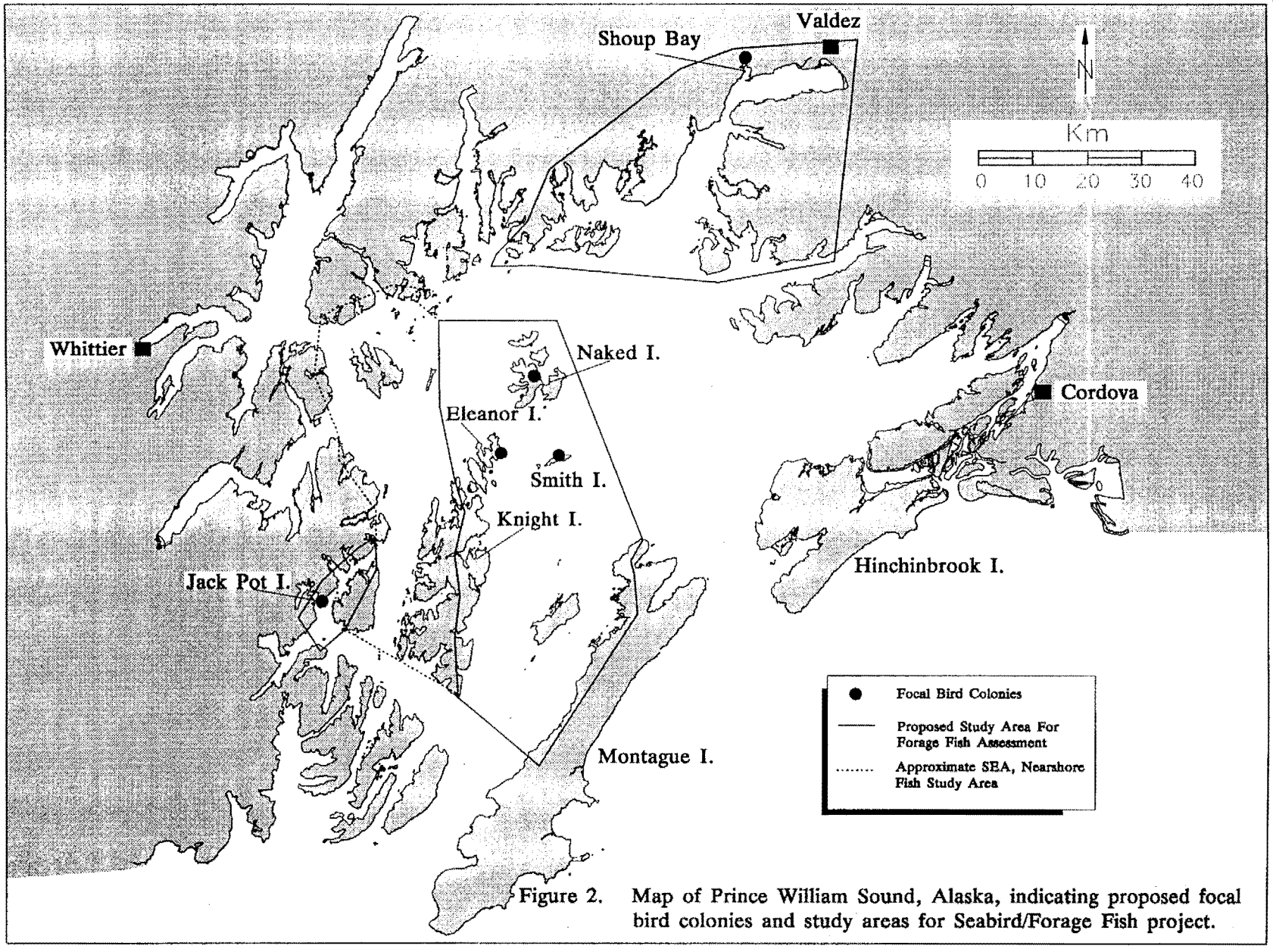


Figure 2. Map of Prince William Sound, Alaska, indicating proposed focal bird colonies and study areas for Seabird/Forage Fish project.

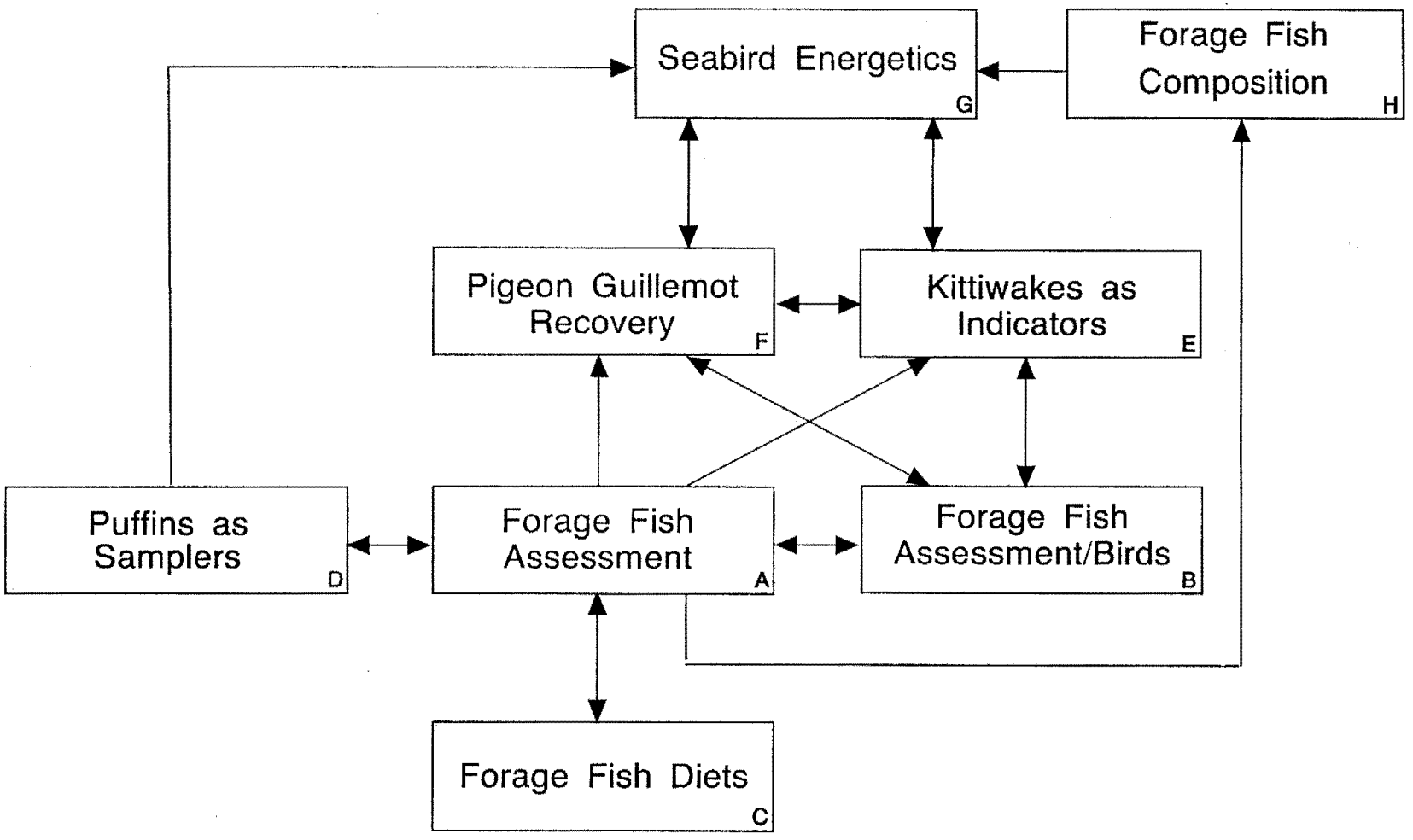


Figure 3. Data exchange among the Seabird/Forage Fish subprojects (95163A-H). Subprojects are indicated by the project letter.

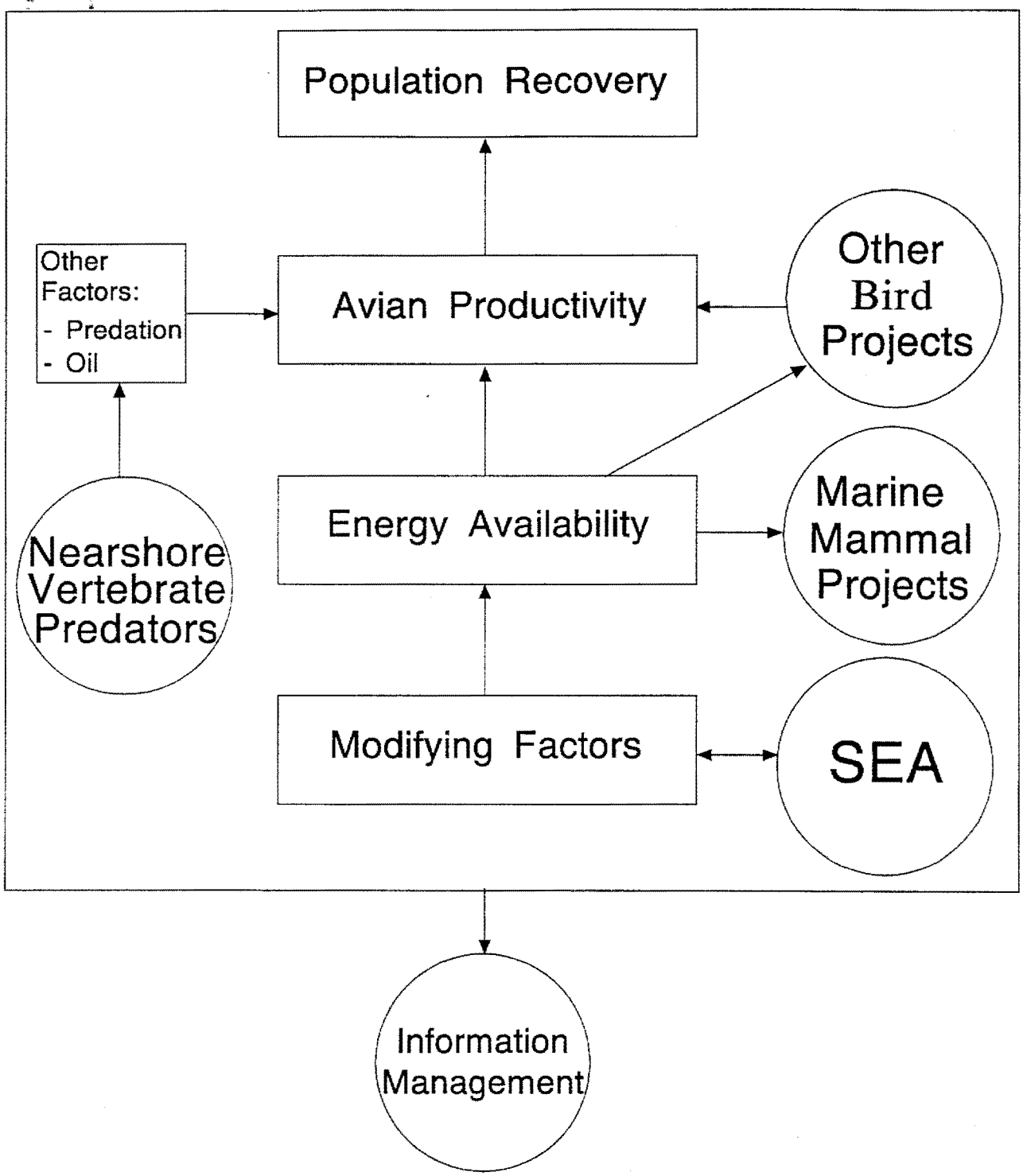


Figure 4. Coordination and information flow between Seabird/Forage Fish project and other projects, which include: SEA-95320 E,H,I,N,T,U; nearshore 95025C; marine mammal projects 95001, 95064, 95117; murre & murrelet projects 95039 & 95031; and the information management projects 95089 and 95320J.

Abundance and Distribution of Forage Fish and Their Influence on Recovery of Injured Species

Project Number:	95163A (formerly 95163)
Restoration Category:	Research (continuation of 94163)
Proposed By:	NOAA
Cooperating Agencies:	DOI & ADFG
Cost FY95:	$482,700
Cost FY96:	$482,700
Total Cost:	Unknown
Duration:	6 years minimum
Geographic Area:	Prince William Sound
Injured Resource/Service:	Multiple Resources

INTRODUCTION

A better understanding is needed of how prey availability affects distribution, abundance, growth, and reproductive success of apex predators. Efforts to restore predatory species affected by the oil spill, particularly harbor seals, pigeon guillemots, marbled murrelets, and black-legged kittiwakes, could be delayed or completely unsuccessful without understanding distribution, abundance, and availability of important forage fish including herring, pollock, sand lance, capelin, and invertebrate species such as macrozooplankton and squid.

NEED FOR THE PROJECT

This is a core component of the Seabird/Forage Fish project (95163A-I), a multi-disciplinary project designed to understand the Prince William Sound (PWS) food web and the associated effects on the injured species.

This project will concentrate on determining distribution, abundance, and availability of important prey species (e.g., herring, pollock, sand lance, capelin, macrozooplankton, squid) to predatory species affected by the oil spill (harbor seals, pigeon guillemots, marbled murrelets, black-legged kittiwakes). This information, trophic position and niche overlap among species, will be used to establish the basic structure of future ecosystem models. The

models of changing oceanographic regimes and prey species productivity and distribution are necessary for understanding recovery of predatory species, and useful in guiding recovery activities.

PROJECT DESIGN

This project will evaluate existing field methods used in determining distribution, abundance, availability, and class composition of forage fish. Provisions will be included to model effects of changing oceanographic regimes on forage fish species' distribution, abundance, and productivity.

The 1995 sampling program will be a continuation of the 1994 pilot project (94163) to determine distribution, densities, and species composition of forage fish species. Field surveys will determine where apex predators forage (95163B), and this project (95162A) will determine distribution, abundance, and availability of forage fish of both nearshore and offshore waters within selected areas of PWS. Ecosystem models to estimate biomass and productivity of forage fish species will be evaluated and initiated (95163I) in coordination with SEA project (95320J).

A. Objectives

Overall objectives: Determine temporal and spatial distribution, abundance, species composition, and availability of important prey species (e.g., herring, pollock, sand lance, capelin, macrozooplankton, squid) in PWS waters. Determine how important biotic and abiotic factors affect both short- and long-term distribution and abundance of prey species in the oil spill area. Determine how predator distribution, abundance, and foraging strategy coincide with forage fish distribution, abundance, and availability.

1995 objectives:

1. Evaluate existing field methods used in determining distribution, abundance and availability of forage fish.
2. Determine temporal and spatial distribution, abundance, and availability of prey species using hydroacoustic surveys and net sampling.
3. Investigate the relationships between forage fish abundance and distribution to oceanographic parameters.
4. Initiate development of ecosystem models to understand factors influencing distribution, abundance, and composition of forage fish.
5. Investigate relationships of forage fish abundance to seabird and marine mammal abundance and productivity, in conjunction with complementary studies (95163 B-I, 95001, 95031, 95039, 95064, 95117, 95320H, 95320N, and 94320T).

B. Methods

Conduct both coarse- and fine-scale hydroacoustic surveys and determine forage fish composition and sizes by net sampling. Coarse scale surveys will consist of line transects spaced throughout the study area. Fine-scale surveys will be located at sites known to be seabird or marine mammal feeding areas. Both coarse- and fine-scale surveys will be conducted during the two 20-day surveys. Survey timing is during the times most important for seabird nesting, July and August (see Figure 1). Four permanent hydroacoustics stations will be established to observe temporal patterns in prey abundances within and between years.

Figure 1. Periods in which forage fish distribution and abundance data, and samples should be collected to support 95163 projects.

Species/ Project #	April		May		June		July		August		Sept.	
Puffins/ 95163D									X	X	X	
Kittiwakes/ 95163E	X	X	X	X	X	X	X	X	X	X		
Pigeon Guillemots/ 95163F							X	X	X			
Seabird Energetics/ 95163G							X	X	X	X		

During hydroacoustic surveys, simultaneous seabird and marine mammal surveys will take place from the same vessel (95163B). Data from this study will be used to understand foraging behavior in relation to abundance and distribution of prey. These data will also be combined with data from other seabird studies to compare relative fish abundance to foraging behavior and reproductive success, marbled murrelets (95031), pigeon guillemots (95163F), and black-legged kittiwakes (95163E).

Forage fish will be sampled in nearshore and offshore areas using nets. Each species will be identified and length and weight measured on a minimum of 150 individuals randomly selected in each sample. Fifteen fish from each species will be preserved from each sample for later analysis of stomach contents (95163C). Additional samples will be collected for later lipid and stable isotope analysis (94320I).

C. Schedule

The forage fish surveys will be conducted under contract. The contractor will conduct two 20-day hydroacoustic and net sampling surveys during July and August. Annual reports will include progress on refining the forage fish models. A project status report will be submitted by the contractor in December, 1994 (94163), which will discuss existing field methods used in determining distribution, abundance, and availability of important prey species, and the process and justifications for selected survey techniques. The report will present and discuss the results of the field surveys including locations of forage fish, and when possible, the biomass of these species, and forage fish prey, as determined from stomach content analysis.

The 1995 report, due April 1996, will present and discuss the results of the FY95 field surveys. The contractor, in collaboration with NOAA, ADF&G, USFWS, 95320J, and 95163I, will report on the correlation of forage fish distribution and abundance with seabirds (marbled murrelet, pigeon guillemot, black-legged kittiwake) and marine mammal abundance and productivity. The report will also describe and evaluate ecological models to estimate productivity of important prey species, and a sampling program to fulfill requirements of ecological models. Annual reports will include progress on refining the productivity models. The contractor will participate in development of a synthesis report prepared by 95163I.

July 1995 - August 1995	Contractor field sampling
September 1995 - 31 March 1996	Analyze data and prepare annual report

D. Technical Support

This project will generate data which will be useful to the monitoring projects and studies currently underway in PWS. To insure access to these data, the information collected from this project will be incorporated into a data base managed by the Trustee Council (95089) and SEA project (95320J).

E. Location

This project will concentrate its initial activities within PWS. The research area consists of three core study blocks: Valdez Arm south to and including the waters around Glacier and Bligh Islands, waters around Naked Island south to The Needles, and waters in the Jackpot Bay/Dangerous Passage area. These areas are not key survey areas for the SEA hydroacoustic studies (95320H and 95320N). However, some of the data from the SEA hydroacoustic studies may be useful in refining the productivity models.

PROJECT IMPLEMENTATION

This project will be contracted and coordinated by NOAA with cooperative components conducted by ADF&G and USFWS.

COORDINATION OF INTEGRATED RESEARCH EFFORT

There are two major components of coordination to insure efficiency in this research package, coordination among the subprojects within the Seabird/Forage Fish project, and coordination between the project and other studies. The Forage Fish Diets component (95163C) will provide information to the Forage Fish Assessment component (95163A) on the dietary overlap among forage fish species, which may provide insight into competition among forage fish. The Puffins as Samplers component (95163D) is linked to the Forage Fish Assessment component in that it may prove to be another method of sampling forage fish. The Forage Fish Assessment component will provide data on fish distribution, abundance, and composition to the Forage Fish Assessment/Birds component (95163B), the Pigeon Guillemot component (95163F), and the Kittiwake component (95163E).

The Forage Fish Assessment component and the Pigeon Guillemot and Kittiwake components will provide complementary and integral information to determine if food is limiting the recovery of seabird species. Data on seabird foraging and reproductive parameters will be compared to the forage fish assessment data to investigate the relationship of food availability or limitation to seabird productivity.

The Forage Fish Assessment component will also provide data on forage fish abundance, distribution, and availability to marine mammal studies (95001, 95064, 95117) to support marine mammal abundance and productivity model development.

The Forage Fish Assessment component will also be highly integrated with several components of the SEA Program and several of the seabird and marine mammal projects. The Physical Oceanography, Nearshore Fish, Zooplankton, and Phytoplankton components of SEA will collect data relevant to forage fish distribution and production. Within the SEA Physical Oceanography component, conductivity-temperature-depth (CTD) profilers and Acoustic Doppler Current Profilers (ADCP) will be deployed from a mid-water trawl vessel. Within the SEA Nearshore Fish component, hydroacoustic data will be obtained in offshore habitats from a mid-water trawl vessel and in nearshore habitats from small hydroacoustic survey boats. Within the SEA Zooplankton and Phytoplankton components, zooplankton and water samples will be collected using nets and water bottles. The Salmon Growth and Salmon Predation components of SEA will collect forage fish samples for later stomach contents analysis in offshore and nearshore habitats using mid-water trawls, and beach and purse seines. Age-weight-length data will be collected from the forage fish to accompany hydroacoustic data.

All data collected as part of SEA will be provided to the Information and Modeling component (95320J) and the Seabird/Forage Fish synthesis component (95163I) for use in development and implementation of ecosystem models.

FY 95 BUDGET ($K)

Personnel	42.8
Travel	6.0
Contractual	400.0
Commodities	1.0
Equipment	6.0
Subtotal	455.8
Gen. Admin.	26.9
Project Total	482.7

Forage Fish Assessment/Birds

Project Number:	95163B (formerly 95163)
Restoration Category:	Research (continuation of 94163)
Proposed By:	DOI
Cost FY 95:	$155,000
Cost FY 96:	$200,000
Total Cost:	Unknown
Duration:	6 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Picivorous birds

INTRODUCTION

Seabirds were severely impacted by the *Exxon Valdez* oil spill; 30,000 carcasses were recovered and estimates of losses exceed several hundred thousand. Three species (common murre, marbled murrelet, and pigeon guillemot) have not recovered from the population perturbation. In addition, recent black-legged kittiwake nesting failures may be linked to the spill. Pinnipeds within Prince William Sound (PWS) have also been declining. These declining species are picivorous. Avian species recovering from the spill forage on other foods. These data suggest that several picivorous species share a common food limitation.

NEED FOR THE PROJECT

Food limitation on seabirds can result from three possible changes in the forage resource:

1. A reduction in the total forage biomass.

2. A shift in the species composition of the forage resource resulting in lower food quality species becoming dominant.

3. Food is present in the ecosystem but no longer available to birds.

Each of these changes, or some combination of them, could have occurred in the spill area. A perturbation or other environmental change could have resulted in a decline in forage fish

recruitment that caused a decline in total biomass. It is also probable that a perturbation caused only some species of the forage fish guild to decline and others have responded to the availability of resources, freed by competitor declines, by increased recruitment. If forage fish guild composition shifts resulted in species of lower food quality becoming dominant, food may become limiting to predator species. A shift in forage fish guild composition could also result in dominance of species that spend most of their life history in water too deep for foraging birds, thereby causing food limitation. Of the proposed subprojects, this is the primary component to determine if food limitation has resulted from item 3, above.

PROJECT DESIGN

This project will be expanding upon established approaches and methods used to investigate forage fish/seabird interactions. Several similar investigations have been conducted at distant study sites (see papers by Schneider, Safina, Piatt, Obst, and Erikstad) as well as Alaska coastal areas (see papers by Piatt and Hunt). Improved data collection equipment, larger sample sizes, and temporal replication will result in a greater insight into forage fish/seabird interactions. The 1995 project will be an expansion of the 1994 project and will be developed in concert with the forage fish assessment subproject (95163A).

A. Objectives

This study will contribute to the objective of the Seabird /Forage Fish project: to determine if food limitation is preventing the recovery of injured seabirds. The overall objective of this subproject is to determine if food limitation is the result of unavailable food resources.

Specifically, the objectives are to determine the following:

1. What are the characteristics and distribution of foraging patches exploited by seabirds?

2. How abundant are foraging patches and what is the rate of their exploitation by seabirds?

3. How does the behavior of seabirds change with changes in food availability?

B. Methods

Seabird and marine mammal surveys will be conducted simultaneously with hydroacoustic surveys (hydroacoustic survey methods are described in proposal 95163A). Mammal and bird surveys will be conducted using standard techniques used previously in seabird and mammal population surveys in PWS. During hydroacoustic transects, all birds and mammals observed within 100 meters of the survey ship will be recorded. Categorical data will also be collected

on bird behavior. Times of observations will be recorded to allow direct comparison of hydroacoustic data to bird and mammal data.

Foraging patches will be defined as sites at which two or more birds are observed foraging. Hydroacoustics data will be used to determine species composition of foraging patches, water depth to patch, and size of patch. Hydroacoustics data will be further analyzed to determine the frequency of occurrence of patches suitable for bird foraging. The rate of exploitation of available forage patches will then be determined. Repeating the surveys for several years will provide data on how forage fish populations are changing and the behavioral responses of seabirds to changes in prey abundance by tracking the rate of forage patch exploitation and the distribution of birds.

C. Schedule

Because of budget constraints only two forage fish surveys and limited nearshore work will be conducted during 1995. Coordination will be made with the SEA project's Nearshore Fish component (95320N) to make up for data shortfalls.

April - July 1995	Coordinate with other studies for data collection
July - August 1995	Forage fish assessment cruises
July 1995 - January 1996	Analyze field data and prepare reports
31 January 1996	Draft report due
31 March 1996	Final report due

D. Technical Support

This project will generate data that will be important to other monitoring projects and studies being conducted in PWS. To facilitate access to project data, the information collected from this study will be incorporated into a data base managed by the Trustee Council and by SEA.

E. Location

This project will concentrate its initial activities within PWS. However in the future some sampling may be performed in the Gulf of Alaska, adjacent to PWS.

PROJECT IMPLEMENTATION

The U. S. Fish and Wildlife Service (USFWS) will obtain necessary data from the Forage Fish Assessment subproject (95163A) and will conduct all other phases of this study. The USFWS has demonstrated that it is the most appropriate entity to conduct this project through its previous monitoring and research on seabirds in PWS.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This subproject is an integral part of the Seabird/Forage Fish project and will provide key information to the synthesis report. This component will be developed in close association with the contractor for the Forage Fish Assessment subproject (University of Alaska). Data collected will be used by the Puffins as Samplers (95163D), Kittiwakes as Indicators (95163E), and Pigeon Guillemot Recovery (95163F) subprojects. Coordination will be made with the SEA project's Juvenile Salmon and Herring Integration component (95320E) and Nearshore Fish (95320N) components to integrate data collection efforts.

FY 95 BUDGET ($K)

Personnel	117.00
Travel	8.0
Contractual	0.0
Commodities	0.0
Equipment	10.0
Subtotal	135.0
Gen. Admin.	20.0
Total	155.0

Competition and Prey of Forage Fish

Project Number:	95163C (was 95163)
Restoration Category:	Research
Proposed By:	ADF&G
Cooperating Agencies:	NOAA & DOI
Cost FY95:	$76,600
Cost FY96:	$76,600
Total Cost:	Unknown
Duration:	6 years minimum
Geographic Area:	Prince William Sound
Injured Resource/Service:	Multiple Resources

INTRODUCTION

A better understanding is needed of how prey availability affects distribution, abundance, growth, and reproductive success of apex predators. Efforts to restore predatory species affected by the oil spill, particularly harbor seals, pigeon guillemots, marbled murrelets, and black-legged kittiwakes, could be delayed or completely unsuccessful without understanding distribution, abundance, and availability of important forage fish. Factors controlling the life history of the forage fish, such as prey and competition, must also be understood.

NEED FOR THE PROJECT

This is a subproject of the Seabird/Forage Fish project (95163A-I), a multi-disciplinary project designed to understand the Prince William Sound food web and the associated effects on the injured species.

This subproject will concentrate on determining diet overlap and prey selection among forage fish species. This information, trophic position and niche overlap among species, will be used to establish the basic structure of future ecosystem models. The models of changing oceanographic regimes and prey species productivity, diet overlap and prey selection, and distribution are necessary for understanding recovery of predatory species, and useful in guiding recovery activities.

PROJECT DESIGN

The 1995 sampling program will be a continuation of the 1994 pilot project (94163) to determine diet overlap and prey selection among forage fish species. This project will also provide information on sex, age, growth, food habits, recruitment, and mortality of forage fish species.

A. Objective

Determine forage fish prey using stomach contents analysis for fish collected from nearshore and offshore sites, and estimate degree of diet overlap among species.

B. Methods

Forage fish will be sampled in nearshore and offshore areas using nets. Each species will be identified and length and weight measured on a minimum of 150 individuals randomly selected in each sample. Fifteen fish from each species will be preserved from each sample for later analysis of stomach contents.

C. Schedule

The forage fish surveys will be conducted under contract. The contractor work will conduct hydroacoustic and net sampling surveys during July and August. Additional samples will be collected by the Salmon Growth and Salmon Predation components of SEA (95320N) for later stomach contents analysis.

July - August 1995	Contractor net sampling
April - November 1995	SEA net sampling
June - 31 December 1995	Conduct stomach contents analysis
1 January - 31 March 1996	Analyze data and prepare annual report

D. Technical Support

This project will generate data that will be useful to the monitoring projects and studies currently underway in Prince William Sound. In order to insure access to these data, the information collected from this project will be incorporated into a data base managed by the Trustee Council (95089) and the SEA project (95320J).

E. Location

This project will concentrate its initial activities within Prince William Sound.

PROJECT IMPLEMENTATION

This project will be contracted and coordinated by ADF&G with cooperative components conducted by NOAA, USFWS, and SEA.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This project will be highly integrated with several components of the Seabird/Forage Fish project, several components of the SEA project, and marine mammal projects. The Salmon Growth and Salmon Predation components of SEA will collect forage fish samples for later stomach contents analysis in offshore and nearshore habitats using mid-water trawls, and beach and purse seines. Age-weight-length data will be collected from the forage fish to accompany hydroacoustic data. All data collected as part of SEA will be provided to the Information and Modeling component 95320J for use in development and implementation of ecosystem models.

FY 95 BUDGET ($K)

Personnel	25.0
Travel	3.0
Contractual	40.0
Commodities	2.0
Equipment	0.0
Sub-total	70.0
Gen. Admin.	6.6
Project Total	76.6

Distribution and Abundance of Forage Fish as Indicated by Puffin Diet Sampling

Project Number:	95163D (formerly 95019)
Restoration Category:	Research (new)
Proposed By:	DOI
Cost FY95:	$32,250
Cost FY96:	$42,250 (includes $10,000 for analysis and write-up)
Total Cost:	Unknown
Duration:	6 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Multiple resources

INTRODUCTION

Tufted puffins are widely distributed in breeding colonies throughout the *Exxon Valdez* oil spill area. During the chick-rearing period, adults make several trips daily to the nest, carrying fresh prey to their young. By intercepting those food deliveries, it is possible to sample the nestling diet of puffins systematically and nonconsumptively. Puffins and other seabirds (murres, murrelets, guillemots, kittiwakes, and others) rely in summer on a food base consisting primarily of forage fish (capelin, sand lance, juvenile pollock, juvenile herring, myctophids, and others). This project will use puffin diet sampling as a means to quantify seasonal, annual, and geographic variation in the composition of the forage fish community at selected stations within the spill area. The project will complement traditional, more costly approaches involving hydroacoustics and net sampling and will also provide a reliable source of seabird prey specimens for laboratory analyses proposed in other projects.

NEED FOR THE PROJECT

Three species of seabirds (common murre, marbled murrelet, and pigeon guillemot) and one pinniped (harbor seal) were injured by the Exxon Valdez oil spill and are not recovering. An additional species (black-legged kittiwake) showed early effects on reproduction (comparing oiled and unoiled areas) and has experienced widespread breeding failure throughout Prince William Sound (PWS) in the last two years. The summer diets of these and other members of the pelagic community of vertebrate predators (birds, mammals, and fish) are known to

overlap. One hypothesis to explain the failure of recovery of injured species is that adverse changes are occurring in the quantity or quality of these species' prey. To test that hypothesis, it is necessary to quantify the status and trends of prey populations, particularly the forage fish that constitute an important part of the summer diet. Few data are available on the distribution and abundance of forage fish, because most species are not commercially harvested, and traditional methods of fishery science tend to be difficult and expensive. In the Gulf of Alaska, tufted puffins have proved to be excellent samplers of the forage fish community, providing annual indices of the distribution and relative abundances of keystone species such as capelin, sand lance, pollock, myctophids, and squids. Conducted over a span of years, this approach offers a cost-effective means of monitoring key components of the pelagic ecosystem and testing the hypothesis that recovery of seabirds and marine mammals is influenced by changes in the composition of marine fish stocks.

Seabirds in general, and puffins in particular, may constitute an important mortality factor on the early life stages of commercially important species. In the Gulf of Alaska, tufted puffins took 11 billion pollock from mid July to mid September in 1986, roughly one-tenth of the first-year juveniles available just prior to chick-rearing and ten times the number of fish surviving to the following March (Hatch and Sanger 1992). On the Barren Islands in 1993, puffins frequently delivered juvenile sockeye salmon, although the smolt were too large to be readily ingested by the chicks, and many went to waste (A. Kettle, pers. comm.).

Whether seabird predation proves to be a significant source of mortality or not, previous results suggest that diet sampling can provide an early indication of year-class strength in some species. For instance, the proportion of pollock in tufted puffin diets at the Semidi Islands (western Gulf of Alaska) was strongly correlated over three years with independent measures of year-class strength obtained in fishery investigations (Hatch and Sanger 1992). A similar outcome might be obtained for sockeye salmon at the Barren Islands or pink salmon in Hinchinbrook Entrance to PWS, where an out-migration of juveniles in late summer and fall (PWS Fisheries Research Planning Group, 1993) would encounter the sizeable puffin colonies on Porpoise Rocks and the Wooded Islands.

Because puffins deliver whole, undamaged prey to their chicks, this project can serve as a source of specimens for determination of prey quality (composition and energy density), population structure (age-sex ratios, genetic stock identification), and trophic studies (fish stomach contents, stable isotope ratios, and/or lipid analysis). Puffin samples have also been used to estimate daily growth increments of juvenile sand lance and pollock (Hatch 1984, Hatch and Sanger 1992).

PROJECT DESIGN

A. Objectives

1. Annually assess the species composition of the forage fish community near selected colonies of seabirds in the northern portion of the Exxon Valdez oil spill area.

2. Cross check the species composition of forage fish as determined by puffin diet sampling and hydroacoustic/net sampling techniques.

3. Assess the timing and magnitude of puffin predation on commercially important prey species including Pacific herring, pink salmon, and sockeye salmon.

4. Furnish whole prey specimens on demand for complementary studies of prey energetics, food web relationships, and fish population characteristics.

B. Methods

Puffin diet samples are collected most efficiently by placing wire screens over the entrances to burrows. Unable to enter, returning adults drop their food loads on or near the screens, which are removed when the samples are retrieved after 1-3 h. Samples are washed, bagged and preserved for later analysis in the laboratory. Any temporal sampling scheme desired can be implemented, but for maximizing the quantity of food obtained, morning hours are productive because puffins generally make a food delivery soon after first daylight.

One issue raised by this sampling approach is whether puffins take different types of prey in proportion to their relative abundances in the water column. Therefore, a desirable element of the field work during the first year of this project would be a comparison of the results from puffin diet sampling with simultaneous deployment of hydroacoustics and net sampling offshore at one or more colonies. The offshore work is not budgeted for in this proposal, but it is anticipated that the coordinated study would be achieved through cooperation with the Forage Fish Assessment subproject (95163A) and SEA components proposed for fiscal year 1995.

C. Schedule

November - June 1995	Recruit personnel, safety training, boat and collection equipment preparation.
June 1995	Reconnaissance of Naked Island group and vicinity for potential sampling sites.
July - August 1995	Field collection of puffin diet samples at Naked Island, Smith Island, or other locations in the core study area of the Seabird/Forage Fish project.
September 1995	Laboratory analysis of food samples.
October - December 1995	Complete laboratory analysis; data analysis and report writing.
January 1996	Draft annual report.
March 1996	Final annual report.

D. Technical Support

No technical support is required during the first year of study. An expanded program in the future may result in sufficient samples to warrant contracting for the identification and measurement of prey items.

E. Location

The intended sampling area during the first year of this project includes Naked Island and/or neighboring islands within the core study area delineated for the Seabird/Forage Fish project (95163A-I). There is a possibility that an insufficient number of puffins, or inaccessibility of their nesting habitat, could preclude the use of the proposed sampling techniques in this area. Thus, a minimum of equipment will be purchased initially, and a reconnaissance of potential sampling sites will be carried out in June, prior to first hatching of puffins. If a determination is made during the June reconnaissance that puffin diet sampling cannot be conducted safely and productively on Naked Island, Smith Island, or other nearby locations, the project will not be further implemented in 1995 and remaining funds will be returned to the EVOS Restoration Office for distribution to other projects.

PROJECT IMPLEMENTATION

This project will be implemented by the National Biological Survey, Alaska Science Center. Center personnel developed the field techniques proposed for puffin diet sampling and have successfully applied the method at more than 20 puffin colonies in the Gulf of Alaska since 1985.

COORDINATION OF INTEGRATED RESEARCH EFFORT

Coordination with offshore operations that sample forage fish by traditional methods is a recommended component of this project. The project will contribute to and draw upon SEA investigations of Juvenile Salmon and Herring Integration (95320), and will use information on physical oceanography generated by other EVOS funded studies in the interpretation of seasonal, annual, and geographic variation in forage fish communities.

PERSONNEL QUALIFICATIONS

Scott A. Hatch, Principal Investigator, is employed as a Supervisory Research Biologist in the Alaska Science Center, National Biological Survey. Dr. Hatch has conducted research on the population dynamics and feeding ecology of seabirds in Alaska since 1975. He has published more than 30 papers on those topics and has managed interagency programs for seabird research and monitoring since 1987. Curriculum vitae are filed and available on request from the Restoration Office, Exxon Valdez Oil Spill Trustee Council.

FY 95 BUDGET ($K)

Personnel	15.0
Travel	2.0
Contractual services	0.0
Commodities	2.0
Equipment	11.0
Subtotal	30.0
Gen. Admin.	2.3
Total	32.3

LITERATURE CITED

Hatch, S.A. 1984. Nestling diet and feeding rates of rhinoceros auklets in Alaska. Pp. 106-115 in D.N. Nettleship, G.A. Sanger, and P.F. Springer, eds. Marine birds: their feeding ecology and commercial fisheries relationships. Can. Wildl. Serv. Spec. Pub., Ottawa.

Hatch, S.A. and G.A. Sanger. 1992. Puffins as samplers of juvenile pollock and other forage fish in the Gulf of Alaska. Mar. Ecol. Prog. Ser. 80:1-14.

PWS Fisheries Research Planning Group. 1993. Sound ecosystem assessment: initial science plan and monitoring program. Rep. No. 1, Cordova, AK.

Kittiwakes as Indicators of Forage Fish Availability

Project Number:	95163E (formerly 95033)
Restoration Category:	Research (new)
Proposed By:	DOI
Cost FY 95:	$198 (includes data analysis and report writing costs)
Cost FY 96:	$198 (includes data analysis and report writing costs)
Total Cost:	$819,000
Duration:	Five years, depending on the frequency and duration of Seabird/Forage Fish project.
Geographic area:	Prince William Sound
Injured Resource/Service:	Multiple resources

INTRODUCTION

Populations of several species of marine birds and mammals that prey on forage fish have declined in Prince William Sound (PWS) since 1972; conversely, species that feed on benthic invertebrates have not declined. Marbled murrelets, pigeon guillemots, arctic terns, black-legged kittiwakes, glaucous-winged gulls, tufted puffins and harbor seals feed on schooling forage fish and have declined by more than 50%. Harlequin ducks, goldeneyes, black oystercatchers, and sea otters feed on benthic invertebrates and have not declined throughout PWS, although some species were affected by the *Exxon Valdez* oil spill. This pattern of declines in piscivorous species and the absence of declines in species consuming benthic invertebrates suggests that marked changes in the forage fish community distribution, abundance, or composition occurred over the last 20 years.

If populations of piscivorous marine birds and mammal populations that were injured by the *Exxon Valdez* oil spill (i.e., common murre, marbled murrelet, pigeon guillemot, and harbor seal) are currently limited by food, recovery of these populations is not likely. Therefore, an important question concerning the recovery of these injured species is, are their populations limited by food. The goal of this study is to evaluate the relative availability of forage fish for kittiwake populations in PWS, which were damaged by the oil spill and may serve as an indicator of other seabird species. This study, in collaboration with other components of the Seabird/Forage Fish project, will provide data to investigate the question; is food limiting?

The Trustee Council funded a kittiwake damage assessment study in 1990, which found that

reproductive success of kittiwakes was damaged by the oil spill. Prior to and after the spill the U.S. Fish and Wildlife Service (USFWS) monitored kittiwake population size and reproductive success in PWS. The USFWS study demonstrated that reproductive success of kittiwakes in PWS has not recovered since the spill. The USFWS monitoring also suggested that food availability to kittiwakes nesting in PWS has decreased. The USFWS monitoring will continue and the proposed study would complement the monitoring effort and provide stronger data to answer the question of food as a limiting factor.

NEED FOR THE PROJECT

The common murre, marbled murrelet, pigeon guillemot, and harbor seal are piscivorous injured species. A major question concerning the recovery of these injured species is; are their populations limited by food?

To answer this question, the best species to study are those that are widespread throughout PWS and for which data on foraging and breeding parameters can easily be collected. In PWS kittiwakes are well suited to address the food limitation question. There are 25 colonies spread throughout PWS, and because kittiwakes are colonial cliff-nesting birds, productivity and brood size can easily be obtained. Other breeding and feeding parameters are also inexpensive and easy to record. Also, there are ten years of population size and productivity data for kittiwakes in PWS that can be used for comparison.

Because kittiwakes prey on many of the same forage fish species as marbled murrelets, pigeon guillemots, and murres, they act as indicator species. However, because kittiwakes are surface feeders, a diving species such as pigeon guillemots should also be studied.

PROJECT DESIGN

A. Objectives

1. Determine relative food availability to kittiwakes by the following:

    a. Monitoring reproductive parameters such as egg laying date, clutch size, hatching success, growth rates, fledging success, brood size at fledging, and overall productivity.

    b. Monitoring diets and foraging parameters such as foraging trip length, foraging trip distance, foraging areas, chick provisioning rates, and species and size of prey consumed.

c. Monitoring survival rates of adults.

B. Methods

Twenty-four kittiwake colonies in PWS and three colonies in the northern Gulf of Alaska will be monitored for productivity and brood size at fledging. Clutch size will be monitored at 10 to 12 colonies in PWS. Hatching success, chick growth rates, fledging success, and diets will be monitored at four to six colonies in PWS. All parameters will be measured at two or three colonies in PWS.

Methods for measuring parameters are described by Irons. All methods have been used successfully in one or more other studies on kittiwakes. Productivity will be determined for entire colonies in PWS and study plots at colonies outside PWS. Productivity is measured by counting the numbers of nests in June, the number of pre-fledging chicks in August, and calculating an average number of chicks per nest. Egg laying dates, clutch sizes, hatching success, chick growth rates, provisioning rates and fledging success will be determined for nests in study plots at colonies. Foraging trip length will be measured using radio-tagged birds and data collection computers to monitor their foraging trips. Foraging trip distance and foraging areas will be determined by locating foraging radio-tagged birds with boats and planes in conjunction with the marbled murrelet project.

C. Schedule

October - May 1995	Prepare for field season
June - August 1995	Field work
August - November 1995	Contract for diet analysis
September - November 1995	Data analysis
December 1995 - January 1996	Report Writing
31 January 1996	Draft Report
31 March 1996	Final Report

D. Technical Support

This project will require technical support for analysis of diet samples and GIS mapping.

E. Location

Kittiwakes will be monitored throughout Prince William Sound at 24 kittiwake colonies in FY 95. In the future, this project will expand to include the oil spill zone of the northern Gulf of Alaska.

PROJECT IMPLEMENTATION

The USFWS will be the lead agency for this project. The USFWS has the technical expertise to conduct this study. Similar projects have been conducted by the USFWS on kittiwakes in PWS in the past. Successful methods have been established to collect and analyze data. The USFWS has trust responsibility for kittiwakes and all other seabirds as designated in the Migratory Bird Treaty Act of 1918.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This is a subproject of the integrated Seabird/Forage Fish project (95163A-I) and will collaborate with other components to investigate whether food availability is limiting the recovery of injured species that prey on forage fish. There will be two major elements of coordination to ensure efficiency in this research program: coordination among the subprojects within the Seabird/Forage Fish project and coordination between the Seabird/Forage Fish project and other projects. Because of the links inherent in questions involving multiple trophic levels, the components of the Seabird/Forage Fish project are highly dependent upon each other. The Forage Fish Assessment component will provide data on fish distribution, abundance, and composition to the Kittiwakes as Indicators study. The Forage Fish Assessment/Bird component will provide data on foraging behavior in relation to fish distribution and abundance to the Kittiwake component. The Pigeon Guillemot and Kittiwake components will share information on the distribution of foraging birds and will compare their data to those of the Forage Fish Assessment/Bird component. Also, much data will be shared between the Seabird Energetics and the Kittiwake components.

Logistics will be coordinated to reduce cost and maximize data collection. The Pigeon Guillemot, Kittiwake, Puffin, and Seabird Energetics components will share field camps and logistical support where practical.

The Seabird/Forage Fish project will coordinate with several other projects in PWS to increase the overall efficiency of the *Exxon Valdez* Trustee Council work plan. All data collected by the Kittiwake subproject will be added to the data base management system that is maintained by the SEA program and to the oil spill office information management system. The Seabird/Forage Fish project program coordinator will ensure that coordination occurs in a timely, efficient manner.

FY 95 Budget ($K)

Personnel	106.9
Travel	6.0
Contractual Services	9.2
Commodities	15.0
Equipment	26.2
Subtotal	163.3
Gen. Admin.	16.7
Total	180.0

Factors Affecting the Recovery of Pigeon Guillemot Populations in Prince William Sound

Project Number:	95163F (formerly 95173)
Restoration Category:	Research (continuation of 94173)
Proposed By:	DOI
Cost FY 95:	$260,000
Cost FY 96:	$260,000
Total Cost:	Unknown
Duration:	5 to 10 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Pigeon Guillemot

INTRODUCTION

The population of pigeon guillemots (*Cepphus columba*) in Prince William Sound (PWS) has decreased from about 15,000 in the 1970's (Isleib and Kessel 1973) to about 3,000 in 1993 (Sanger and Cody 1993). There is some evidence (Oakley and Kuletz 1993) suggesting that this population was in decline before the *Exxon Valdez* oil spill in March of 1989. An estimated 2,000 to 3,000 pigeon guillemots were killed throughout the spill zone immediately after the spill (Piatt et al. 1990). Based on censuses taken around the Naked Island complex (Naked, Peak, Storey, Smith, and Little Smith Islands), pre-spill counts (ca. 2,000 guillemots) were roughly twice as high as post-spill counts (ca. 1,000 guillemots; Oakley and Kuletz 1993). Also, relative declines in the numbers of guillemots were greater along oiled shorelines than along unoiled shorelines.

Adult guillemots delivered significantly fewer schooling fish, particularly sand lance (*Ammodytes hexapterus*), to their chicks after the spill (Oakley and Kuletz 1993). In 1994, sand lance accounted for about 1% of prey items fed to guillemot chicks at Jackpot Island and about 8% at Naked Island; by contrast, the sand lance component at Naked Island in 1979 was about 55% (Kuletz 1983). Gadids were much more prevalent in the diet of guillemot chicks on Naked Island in 1994 (ca. 30%) than they were in 1979-1981 (< 7%; Kuletz 1983). The apparent decline in the abundance of sand lance and change in relative proportions of other benthic and schooling fish in the diet of guillemot chicks might represent a key change in the PWS ecosystem that is affecting several species of marine birds and mammals that were injured by the spill.

Predation on eggs and chicks, not important previously (Oakley 1981), might have played a role in the lower reproductive success of guillemots after the spill (Oakley and Kuletz 1993). On Naked Island, nest predation was an important factor affecting the productivity of guillemots during the 1994 breeding season.

This study is a continuation of the Pigeon Guillemot Recovery Monitoring Project (94173), which began in 1994 and was funded by the Trustee Council. Also funded by the Trustee Council was an extensive survey of pigeon guillemot colonies in PWS (93034; Sanger and Cody 1993). Bird Study Number 9 (Oakley and Kuletz 1993), begun in 1989 immediately after the oil spill, compared various population and reproductive parameters of pigeon guillemots before (Oakley and Kuletz 1979; Kuletz 1981, 1983; Oakley 1981) and after the spill.

The goal of this study is to determine whether food, predation, toxicity from oil, or any combination of these is limiting the recovery of pigeon guillemot populations in PWS. The Forage Fish Assessment subproject (95163A) will provide information on the abundance, distribution, and species composition of forage fish in the study areas. In addition, specific information on the energy content and nutritional value of various forage fishes will be provided by the Seabird Energetics (95163G) and Forage Fish Composition (95163H) subprojects. The data gathered by the above components of the Seabird/Forage Fish project, in conjunction with our own studies of guillemot diet and foraging habits, will help us address the hypothesis that food is limiting recovery.

NEED FOR THE PROJECT

Considerable baseline data on pigeon guillemot populations and their foraging and reproductive ecology in PWS have been collected both before and after the oil spill. Continuation of these efforts is essential for monitoring any trends in the PWS populations and determining what factors are limiting their recovery. Food supply, predation, or oil toxicity might limit reproductive success. This project will attempt to evaluate the relative importance of each of these three factors.

Pre-spill studies of pigeon guillemots breeding at Naked Island suggest that sand lance are a preferred prey during chick-rearing (Kuletz 1983). Breeding pairs that specialized on sand lance tended to initiate nesting attempts earlier and produce chicks that grew faster and fledged at higher weights than breeding pairs that preyed mostly upon blennies and sculpins, at least in years when sand lance were readily available. Consequently, the overall productivity of the guillemot population was higher when sand lance were available. The post-spill decline in the prevalence of sand lance in the diet of guillemots breeding at Naked Island might be a key element in the failure of this species to recover from the oil spill. The schooling behavior of sand lance, coupled with their high lipid content relative to that of

gadids and nearshore bottom fish, might make this species a particularly high-quality forage resource for PWS pigeon guillemots. This is consistent with the observation that other seabird species (e.g., puffins, murres, kittiwakes) experience enhanced reproductive success when sand lance are available (Pearson 1968; Harris and Hislop 1978; Hunt et al. 1980; Vermeer 1979, 1980). This project, in conjunction with the Seabird Energetics subproject (95163G), will help assess the relative importance of sand lance and other forage fish resources for successful reproduction in PWS guillemots. There is a critical need for this information to understand the constraints that currently limit the recovery of seabirds and marine mammals damaged by the oil spill.

PROJECT DESIGN

A. Objectives

1. Determine if availability of food is limiting reproductive success of guillemots by collecting the following kinds of data:

    a. Measuring breeding parameters, including phenology, egg volume, chick growth rates, fledging weights, and reproductive success at colonies on Naked and Jackpot Islands.

    b. Measuring foraging parameters, including diet and provisioning rates of chicks, duration of foraging trips, and location of foraging areas.

    c. Obtaining independent data from the Forage Fish Assessment subproject (95163A) on the abundance of various forage fishes within the foraging areas used by guillemots during the chick-rearing period.

2. Determine if predation on eggs or chicks is limiting reproductive success by measuring relative rates of predation during the egg and chick stage in different habitats and at different colonies.

3. Determine if toxicity from petroleum hydrocarbon residues is limiting reproductive success by analyzing unhatched eggs and the carcasses of adults and chicks, and by analyzing blood samples from adults and chicks for biomarkers of stress associated with ingestion of petroleum hydrocarbons (in conjunction with project 95025C).

4. Determine if adult survival and recruitment are limiting the recovery of the guillemot population in PWS by resighting individually color-marked birds.

B. Methods

About 60 guillemot nests on Naked Island and 40 guillemot nests on Jackpot Island were located during the 1994 field season. Although not all of these were accessible to field personnel, they were monitored in some manner (e.g., for productivity and chick growth rates when possible, or at least provisioning rates if nests were inaccessible). These same two study sites will be used during the 1995 field season. We expect to find a few more accessible nests at Jackpot Island and several more at Naked Island during the next field season.

Reproductive success will be monitored using standard field techniques involving periodic nest checks. A portable, infrared-sensitive video camera system, specifically designed for inspecting dark burrows and holes, will be used to monitor those nests that cannot be checked by conventional means.

Morphometric data for determining growth rates will be acquired at regular intervals during the chick-rearing period. Provisioning rates and diets of chicks will be determined whenever possible throughout this period by observing them from strategically located blinds or from boats anchored offshore. Using VHF radio communications between observers in blinds and others in boats, attempts will be made to track guillemots to their foraging areas.

During the 1994 field season, we found conclusive evidence of predation on the eggs and chicks of guillemots on Naked Island. Strong evidence suggests that river otters (*Lutra canadensis*) were responsible for some of this predation. Other mustelids, such as mink (*Mustela vison*), might also be involved. There are conflicting reports as to whether mink are still present on Naked Island. Baited traps were used in 1994 in an unsuccessful attempt to document the presence of mink on the island. We will continue with this effort in 1995. Any evidence of predation will be collected or recorded. Also, time-lapse videography, or that triggered by infrared sensors, will be used in an attempt to document predation and identify predators, as well as to monitor activity budgets of chick-rearing guillemots.

An approved protocol will be used to collect unhatched eggs, which will be stored and shipped in sealed jars for hydrocarbon analysis.

Blood samples for biomarker analyses will be collected using standard protocols developed in collaboration with project 95025C (Bioindicators of Ecosystem Health: Guillemots and River Otters).

Estimates of adult survival will require the successful marking of birds (especially breeding adults, which are likely to return to the same nest each year) with unique color band combinations during the 1995 and future field seasons. In 1994, 80 birds were banded (19 adults and 61 chicks). Various methods of capturing adults (mist nets, noose mats, net traps

at the nest entrance, and by hand at the nest) were tried in 1994. Although almost all of these methods are quite labor-intensive, certain methods are more effective at particular phases of the breeding season. Thus, we should be able to band more adults next year if we plan our capture efforts accordingly. Because of the high degree of nest-site fidelity in pigeon guillemots, known breeding birds not sighted the following season will be assumed to be dead. Marked birds are also useful in determining sex, activity budgets, and reproductive histories of individual birds.

C. Schedule

October - December 1994	Data analysis
December - January 1995	Report writing
31 January 1995	Draft report
31 March 1995	Final report
May - August 1995	Field work/data collection
September - November 1995	Data analysis
December - January 1996	Report writing
31 January 1996	Draft report
31 March 1996	Final report

D. Technical Support

Hydrocarbon analyses of unhatched eggs will be subcontracted to Texas A&M University.

E. Location

Most, if not all, of our work in 1995 will be concentrated on Naked Island and Jackpot Island. Naked Island is ideal for studying pigeon guillemots for the following reasons: 1) Naked and nearby islands (Peak, Storey, Smith, and Little Smith) support approximately one fourth of the guillemots in PWS; 2) there are many previously identified, accessible nest sites on the island; 3) there are excellent baseline data on the island's guillemot population that were obtained both before and after the oil spill, and finally; 4) Cabin Bay provides a suitable field camp site and an excellent anchorage for our boats. Jackpot Island was first used as a study site for pigeon guillemots in 1994. Its small size and numerous accessible nests make it an excellent study site. In 1994, a considerable effort was made to find other guillemot study sites in PWS, but these two islands are the only ones that met our criteria: large numbers of guillemots and accessible nest sites.

PROJECT IMPLEMENTATION

The U. S. Fish and Wildlife Service has the appropriate expertise to conduct the monitoring project outlined above. This agency employs several people with extensive experience in studying the breeding biology and feeding ecology of guillemots. The transport of field equipment from Whittier to Naked Island by barge and the hydrocarbon analyses will be subcontracted.

COORDINATION OF INTEGRATED RESEARCH EFFORT

This proposed study is a component or subproject of the larger Seabird/Forage Fish project (95163A-I). The Forage Fish Assessment subproject (95163A) will provide the Pigeon Guillemot Recovery component with data on fish distribution, abundance, and species composition, while the Forage Fish Assessment/Birds subproject (95163B) will provide pertinent data on the foraging behavior of guillemots in relation to the distribution and abundance of forage fish. At the guillemot study sites (Naked and Jackpot Islands), personnel from the Pigeon Guillemot Recovery subproject (95163F) will work closely with those of the Seabird Energetics subproject (95163G). Because of the difficulty in finding accessible nests, it is imperative that the Seabird Energetics component have access to most of the pigeon guillemot nest sites that were located and used during the 1994 field season. The Principal Investigators (D. Lindsey Hayes, 95163F; Dr. Dan Roby, 95163G) of these two components have agreed to share access to most of these nests. In addition, they are coordinating their efforts so that the kinds of data and measurements needed by each component are collected only once, and in the same manner. This might involve a division of labor (and possibly nest sites, or even study sites) between the two subprojects and subsequent sharing of the data, or perhaps having members from each field crew present during each nest check. Dr. Roby is also one of the Principal Investigators on the Bioindicators project (95025C), and in support of that project, we expect to help him obtain blood samples from guillemot adults and chicks during our routine nest checks.

The Puffins as Samplers subproject (95163D) and the Marbled Murrelet project (95031) might have field camps on Naked Island during the 1995 field season. The Seabird Energetics subproject (95163G) will be based either at Naked Island or in the vicinity of Jackpot Island. Any of these studies that are based at Naked Island will share transport costs. The Eleanor Island component of the Kittiwakes as Indicators subproject (95163G) will share costs for the delivery of their fuel caches. Also, combining field camps will make communications between various groups and their respective offices easier and obviate the need for each group to purchase its own radio and antenna. Increased numbers of personnel at a given location can sometimes enhance the collection of data, such as opportunistic observations of rare events that might be pertinent to a particular study.

FY 95 BUDGET ($K)

Personnel	151.0
Travel	11.0
Contractual	30.0
Commodities	15.0
Equipment	28.3
Subtotal	242.0
Gen. Admin.	24.7
Total	260.0

LITERATURE CITED

Harris, M.P., and J.R.G. Hislop. 1978. The food of young Puffins *Fratercula arctica*. J. Zool. Lond. 85:213-236.

Hunt, G.L., and Z. Eppley, B. Burgeson, and R. Squibb. 1981. Reproductive ecology, food and foraging areas of seabirds nesting on the Pribilof Islands, 1975-1979. OCS Final report, Biological Studies, NOAA Environ. Res. Lab, Boulder, Colo.

Isleib, M.E.P., and B. Kessel. 1973. Birds of the north Gulf Coast - Prince William Sound region, Alaska. Biol. Pap. Univ. of Alaska 14:1-149.

Kuletz, K.J. 1981. Feeding Ecology of the Pigeon Guillemot (*Cepphus columba*) at Naked Island, Prince William Sound, Alaska and surveys of the Naked Island complex. U.S. Fish and Wildlife Service. Special Studies, Anchorage, Alaska. 23 pp.

Kuletz, K.J. 1983. Mechanisms and consequences of foraging behavior in a population of breeding Pigeon Guillemots. Unpublished M.S. Thesis. Univ. of California, Irvine. 79 pp.

Oakley, K.L. 1981. Determinants of population size of Pigeon Guillemots *Cepphus columba* at Naked Island, Prince William Sound, Alaska. Unpublished M.S. Thesis. Univ. of Alaska, Fairbanks. 65 pp.

Oakley, K.L., and K.J. Kuletz. 1979. Summer distribution and abundance of marine birds and mammals near Naked Island, Alaska. U.S. Fish and Wildlife Service, Special Studies, Anchorage, Alaska. 95 pp. + appendices.

Oakley, K.L., and K.J. Kuletz. 1993. Population, Reproduction and Foraging ecology of Pigeon Guillemots at Naked Island, Prince William Sound, Alaska, Before and After

the *Exxon Valdez* Oil Spill. Bird Study Number 9. 65 pp.

Pearson, T.H. 1968. The feeding biology of sea-bird species breeding on the Farne Islands, Northumberland. J. Anim. Ecol. 37:521-552.

Piatt, J.F., C.J. Lensink, W. Butler, M. Kendziorek, and D.R. Nysewander. 1990. Immediate impact of the 'Exxon Valdez' oil spill on marine birds. Auk 107:387-397.

Sanger, G.A., and M.B. Cody. 1993. Survey of Pigeon Guillemot Colonies in Prince William Sound, Alaska. U.S. Fish and Wildlife Service. Final Report. 58 pp.

Vermeer, K. 1979. A provisional explanation of the reproductive failure of Tufted Puffins *Lunda cirrhata* on Triangle Island, British Columbia. Ibis 121:348-354.

Vermeer, K. 1980. The importance of timing and type of prey to reproductive success of Rhinoceros Auklets (*Cerorhincha monocerata*). Ibis 122:343-354.

Diet Composition, Reproductive Energetics, and Productivity of Seabirds Damaged by the *Exxon Valdez* Oil Spill

Project Number:	95163G (formerly 95118-BAA)
Restoration Category:	Research (new)
Proposed By:	University of Alaska Fairbanks
Lead Trustee Agency:	NOAA
Cost FY 95:	$140,600
Cost FY 96:	$144,100
Total Cost:	Unknown
Duration:	5 years (useful results can be obtained in 3 years, but to be effective the project should be supported a minimum of 4 years)
Geographic Area:	Prince William Sound (Naked Island, Shoup Bay, Eleanor Island, Jackpot Island, Icy Bay)
Injured Resource/Service:	Multiple resources

INTRODUCTION

Three seabird species that were damaged by the *Exxon Valdez* oil spill (EVOS) are failing to recover at an acceptable rate: pigeon guillemot (*Cepphus columba*), common murre (*Uria aalge*), and marbled murrelet (*Brachyramphus marmoratus*). Damage from the spill to a fourth species of seabird, black-legged kittiwake, is equivocal, but recent reproductive failures of kittiwakes within the spill area may be due to longer term ecosystem perturbation related to the spill (D. Irons, pers. comm.). The status of pigeon guillemots and marbled murrelets in Prince William Sound (PWS) and the Northern Gulf of Alaska has been of concern for nearly a decade due to declines in numbers of adults observed on survey routes (Laing and Klosiewski 1993).

The failure of these seabirds to recover has been attributed to low reproductive success, but there is a troubling lack of information on the factors ultimately responsible for low productivity. One prevalent hypothesis is that changes in the abundance and species composition of forage fish resources within the spill area has resulted in food provisioning rates that are below the requirements of growing nestlings. Concurrent population declines in some marine mammals, particularly harbor seals, have also been blamed on food limitations.

Whether these changes in forage fish availability are related to or have been exacerbated by EVOS is unknown.

Reproductive success in seabirds is largely dependent on foraging constraints experienced by breeding adults. Previous studies on the reproductive energetics of seabirds have indicated that productivity is energy-limited, particularly during brood-rearing (Roby 1991a). Also, the young of most seabird species accumulate substantial fat stores prior to fledging, an energy reserve that is crucial for post-fledging survival. Data on foraging habitats, prey availability, and diet composition are critical for understanding the effects of changes in the distribution and abundance of forage fish resources on the productivity and dynamics of seabird populations.

The composition of forage fish is particularly relevant to reproductive success because it is the primary determinant of the energy density of chick diets. Parent seabirds that transport chick meals in their stomachs (e.g., kittiwakes) or in a specialized pouch (e.g., auklets) normally transport meals that are close to the maximum load. Seabirds that transport chick meals as single prey items held in the bill (e.g., guillemots, murres, murrelets) experience additional constraints on meal size if optimal-sized prey are not readily available. Consequently, seabird parents that provision their young with fish high in lipids are able to support faster growing chicks that fledge earlier and with larger fat reserves. This is because the energy density of lipid is approximately twice that of protein and carbohydrate. Also, most of the nonlipid dry matter in fish consists of protein, and metabolism of protein as an energy source requires the energetically expensive process of excreting the resultant nitrogenous waste. While breeding adults can afford to consume prey that are low quality (i.e., low in lipid) but abundant, reproductive success is largely dependent on provisioning young with high quality food items. If prey of adequate quality to support normal nestling growth and development are not available, nestlings either starve in the nest or prolong the nestling period and fledge with low fat reserves.

Forage fish vary considerably in lipid content, lipid:protein ratio, energy density, and nutritional quality. Much of the energy content of prey consumed by seabirds is in the form of neutral lipids, especially triglycerides and wax esters, and wax esters in particular are known to be difficult to digest (Nevenzel 1970; Lee et al. 1972; Benson et al. 1972; Sargent 1976; Clarke 1984, In press). In some seabird prey, such as lanternfishes (Myctophidae), lipids may constitute as much as 50% of dry mass (A. R. Place, unpubl. data); while in other prey, such as juvenile walleye pollock (*Theragra chalcogramma*), lipids are less than 5% of dry mass (J. Wejak, unpubl. data). This means that a given mass of lanternfish has more than twice the energy content of the same mass of juvenile pollock. Published values for lipid content (% dry mass) of other forage fish are intermediate between those of lanternfish and juvenile pollock: herring (Clupeidae)- 36.7%, sand lance (Ammodytidae) - 24.4%, smelt (Osmeridae) - 15.8%, capelin (*Mallotus villosus*) - 15.3% (Montevecchi et al. 1984, Barrett et al. 1987, Massias and Becker 1990). These studies have shown that for a particular species

of forage fish, lipid content can vary widely with season, sex, reproductive status, and age class. For example, sand lance can vary from 10% lipid (% dry mass) to 31.5% lipid (Hislop et al. 1991) and gravid female capelin have nearly twice the energy density of male capelin (Montevecchi and Piatt 1984). By increasing the proportion of high-lipid fish in chick diets, parents can increase the energy density of chick meals in order to compensate for the low frequency of chick feeding (Ricklefs 1984a, Ricklefs et al. 1985).

NEED FOR THE PROJECT

This study is relevant to the Seabird/Forage Fish project (95163A-I) and EVOS Restoration Work because it is designed to develop a better understanding of how shifts in the diet of seabirds breeding in PWS affect reproductive success. Unlike marine mammals, seabirds offer the possibility of directly measuring diet composition and feeding rates, and their relation to productivity. By monitoring the composition and provisioning rates of seabird nestling diets, prey preferences can be assessed. Measuring provisioning rates is crucial because even very poor quality prey may constitute an acceptable diet if it can be supplied at a high rate. Understanding the diet composition, foraging niche, and energetic constraints on seabirds breeding within the spill area will be crucial for designing management initiatives to enhance productivity in species that are failing to recover from EVOS. If forage fish that are high in lipids are an essential resource for successful reproduction, then efforts can be focused on assessing stocks of preferred forage fish and the factors that impinge on the availability of these resources within foraging distance of breeding colonies in PWS. As long as the significance of diet composition is not understood, it will be difficult to interpret shifts in the utilization of forage fishes and develop a management plan for effective recovery of damaged species.

There is a definite need for information on the relationship between diet and reproductive success for pigeon guillemots, common murres, and marbled murrelets, all seabird species that are failing to recover from EVOS at an acceptable rate. However, the latter two species pose serious problems for studies of diet composition in the spill area. For common murres it is difficult to collect quantitative data on diet composition, feeding rate, meal size, and chick growth rates without seriously impacting productivity because this species nests in dense colonies on narrow ledges where human activity can cause high losses of eggs and chicks. Also, murre chicks leave the nest site to go to sea at only c. 21 days post-hatch, when they are only 20% of adult mass. In addition, the murre colonies most damaged by the spill and slowest to recover are located in the Barren Islands, where few nesting ledges are accessible. Marbled murrelet nests are usually located high in mature conifers and are very difficult to locate. Most nest visits by parents provisioning young occur at night, so monitoring chick diets is highly problematic. While some limited information on chick diets may be obtained as part of on-going EVOS studies of common murres in the Barren Islands (project 95039, "Common Murre Productivity Monitoring") and marbled murrelets breeding on Naked Island

(project 95031, "Reproductive Success as a Factor Affecting Recovery of Murrelets in PWS"), neither of these species are feasible study subjects for assessing the role of diet composition for seabird reproductive success in the spill area. Consequently, the Principal Investigators (PIs) in the Seabird/Forage Fish project have agreed to focus their efforts on pigeon guillemots and black-legged kittiwakes nesting in PWS.

Guillemots are the most neritic members of the seabird family Alcidae (i.e., murres, puffins, and auks), and like the other members of the family, capture prey during pursuit-dives. Pigeon guillemots are a well-suited species for monitoring forage fish availability for several reasons: (1) they are a common and widespread seabird species breeding in PWS (Sowls et al. 1978); (2) they primarily forage within 5 km of the nest site (Drent 1965); (3) unlike most seabird species, they do not breed in large, dense colonies; (4) they raise their young almost entirely on fish; (5) they prey on a wide variety of fishes, including schooling forage fish (e.g., sand lance, herring, smelt) and subtidal/nearshore bottom fish (blennies, sculpins; Drent 1965, Kuletz 1983); (6) the one- or two-chick broods are fed in the nest until the young reach adult body size. In addition, there is some evidence that many guillemot pairs breeding at Naked Island before the spill specialized on schooling forage fish, particularly sand lance, during the chick-rearing period. Reproductive success of these pairs was lower when sand lance was less available (Kuletz 1983). Guillemots carry whole fish in their bills to the nest-site to feed their young. Thus individual prey items can be identified, weighed, measured, and collected for composition analyses.

Black-legged kittiwakes also breed abundantly in the spill area and rely largely on forage fish during reproduction. Unlike guillemots, kittiwakes are efficient fliers, forage at considerable distances from the nest, and capture prey at or near the surface. Although kittiwakes are highly colonial, cliff-nesting seabirds, they construct nests and can be readily studied at the breeding colony without causing substantial egg loss and chick mortality. Several breeding colonies of black-legged kittiwakes in PWS are easily accessible so that chicks can be weighed regularly without resorting to technical climbing (D. Irons, pers. comm.). Diets fed to kittiwake chicks in PWS consist primarily of schooling forage fish (i.e., sand lance, herring, juvenile walleye pollock), but when forage fish are scarce, euphausiids may be substituted. Like guillemots, kittiwakes can raise one- or two-chick broods, and chicks remain in the nest until nearly adult size. Together with pigeon guillemots, black-legged kittiwakes are excellent bioindicators of the distribution and abundance of preferred forage fish in PWS.

The proposed research is the first focused study to investigate the effects of diet composition on reproductive energetics and productivity of piscivorous seabirds in PWS. The research will result in a fundamental advance in our understanding of the significance of prey composition for pigeon guillemot and black-legged kittiwake reproduction, as well as for other seabirds and marine mammals that breed in PWS. The research will also provide new information relevant to several additional areas of study: (1) comparative biochemical

composition and physiological condition of forage fishes, (2) factors such as age class, sex, size, and reproductive status as they influence the nutritional quality of forage fishes, (3) responses of breeding seabirds to shifts in prey availability, and (4) the energetic consequences of foraging on different prey with differing energy content. This research will be the first to (1) measure the nutritional quality of various forage fishes used by breeding seabirds in PWS, (2) use data on diet composition and provisioning rates to construct energetics models of chick growth and survival, and (3) monitor fat deposition rates of individual seabird chicks on differing dietary regimes by repeated, noninvasive analysis. In addition, the results will have broader implications for our understanding of dietary constraints on reproductive success in other piscivorous seabirds damaged by the spill (common murre, marbled murrelet) and will enhance our understanding of the adaptive significance of prey preferences in these seabirds. These results are crucial for understanding the factors constraining recovery of seabirds and marine mammals damaged by the spill.

PROJECT DESIGN

A. Objectives

The overall objective of the proposed research is to determine the energy content and nutritional value of various forage fishes used by seabirds breeding in the EVOS area, and to relate differences in prey quality and availability to reproductive success and physiological condition of breeding adults. The proposed research will emphasize pigeon guillemots and black-legged kittiwakes for practical reasons, but prey composition and quality will be evaluated for common murres, marbled murrelets, and tufted puffins as data and samples permit. Specific objectives are enumerated below:

1. To determine the nutritional quality of various forage fish species consumed by seabirds in the EVOS area as a function of size, sex, age class, and reproductive status, including:
   a. lipid content
   b. water content
   c. ash-free lean dry matter (protein) content
   d. energy density (kJ/g fresh mass)
   e. lipid composition (triglyceride, wax ester, mono- and diglyceride, free fatty acid, phospholipid)

2. To determine dietary parameters of pigeon guillemot and black-legged kittiwake chicks in PWS, including:
   a. provisioning rate (meal size X delivery rate)
   b. taxonomic composition of the diet
   c. biochemical composition of the diet

d. energy density of the diet

3. To determine the relationship between diet and the growth, development, and survival of seabird nestlings. Variables measured will include:
   a. growth rates of total body mass, lean body mass, and total body fat
   b. rates and patterns of flight feather development
   c. fledgling body mass and fat reserves
   d. fledging age

4. To determine the contribution of specific forage fish resources to the overall productivity of seabird breeding pairs, including:
   a. body composition (physiological condition) of parents raising chicks
   a. gross foraging efficiency of parents
   b. conversion efficiency of food to biomass in chicks
   c. net production efficiency of the parent/offspring unit

B. Methods

The proposed research approach utilizes a combination of sample/data collection in the field (in conjunction with other Seabird/Forage Fish subprojects in PWS) and laboratory analyses. Sample collection and field data collection will be conducted concurrently during the 1995-1998 breeding seasons at two guillemot and two kittiwake colonies in PWS. A minimum of 50 active and accessible nests of each species will be located and marked prior to hatching at each of the study colonies during the four breeding seasons. These nests will be closely-monitored until the young fledge or the nesting attempt fails.

Fresh samples of forage fishes used by guillemots will be collected for proximate analysis using three techniques: (1) temporarily placing "neckties" on guillemot chicks to prevent them from swallowing prey delivered by parents and retrieving samples from chicks, (2) temporarily placing obstructions in the entrance of guillemot nest crevices immediately after arrival of an adult with a chick meal and retrieving samples from adults, and (3) capturing adults carrying forage fish in noose traps as they approach the nest and retrieving samples from adults. Supplemental samples of guillemot forage fishes will be collected using minnow traps deployed in guillemot foraging areas and netting specimens at low tide. Kittiwakes transport chick meals in the stomach and esophagus, so chick diet samples will consist of semi-digested food. Kittiwake meal samples are normally collected when chicks regurgitate during routine weighing and measuring. Fresh specimens of forage fishes used by kittiwakes will be provided from at-sea trawls conducted as part of the Seabird/Forage Fish subproject 95163A, "Abundance and Distribution of Forage Fish and their Influence on Recovery of Injured Species." Fresh fish samples and kittiwake regurgitations will be weighed (± 0.1 g) in the field and immediately frozen in small, propane-powered freezers that will be maintained at each of the four study sites. Samples will be shipped frozen to my laboratory

at the University of Alaska Fairbanks, where they will be kept in an ultra-low freezer at -70°C until proximate analysis. In the lab, forage fish specimens will be reweighed (± 0.1 mg), identified to species, aged, sexed, measured, and reproductive status (gravid, recently spawned, nonreproductive) determined. Kittiwake regurgitations will be sorted into prey classes to the extent feasible, but otherwise handled as with fresh prey samples. Forage fish specimens will be dried to constant mass in a convection oven at 60°C to determine water content. Lipid content of a subsample of dried forage fish will be determined by solvent extraction using a soxhlet apparatus and petroleum ether as the solvent system. Lean dry fish samples will then be ashed in a muffle furnace at 550°C in order to calculate ash-free lean dry mass by subtraction. A subsample of dried forage fish samples will be combusted in a bomb calorimeter to determine energy density. Energy content of chick diets will be calculated from both the energy densities determined by bomb calorimetry and the composition (water, lipid, lipid-free dry matter, and ash) of forage fish along with published energy equivalents of these fractions (Roby 1991).

The lipid composition of forage fish (percentage wax esters, triglycerides, mono- and diglycerides, free fatty acids, and phospholipids of total lipids) will be determined by extracting total lipids from a subsample of fresh-frozen forage fish using the Bligh and Dyer (1959) technique. Extracted lipids will then be separated into the various lipid classes and quantitated using TLC/FID analysis procedures on a Mark IV Iatroscan. This procedure will allow us to determine the percentage of total lipids in forage fish that are in the form of wax esters and other refractory (hard to digest) lipid classes (Roby et al. 1986). My laboratory is equipped with all the instrumentation required for proximate analysis of samples, including a Soxtec HT-12 soxhlet apparatus; an Iatroscan TLC/FID system; and a Parr automated adiabatic bomb calorimeter.

Chick provisioning rates for pigeon guillemots and black-legged kittiwakes in PWS will be determined by monitoring active nests to determine meal delivery rates throughout the 24 h period. Average meal size, taxonomic and biochemical composition of the diet, and average energy density of chick meals will be determined as part of analyses of diet samples collected from guillemot and kittiwake chicks.

Known-age chicks will be weighed and measured regularly to determine individual growth rates throughout the nestling period. Total body fat of chicks at 20 and 30 days post-hatch will be determined by noninvasive (nondestructive) measurement of total body electrical conductivity (Walsberg 1988, Roby 1991). Fat reserves of chicks will be measured in the field using total body electrical conductivity (TOBEC) fat analyzers (SA-3000 Small Animal Body Composition Analyzer from EM-SCAN, Inc., Springfield, IL) that I currently have in my lab. The TOBEC method relies on the major difference in conductivity between lipids and other body constituents to estimate total lean body mass (Pethig 1979; Van Loan and Mayclin 1987). The difference between total body mass, as determined by weighing, and lean body mass, estimated by TOBEC, provides an estimate of total body fat. A major

advantage of the technique is that measurements can be obtained rapidly and repeatedly without harm to the subject. Also, validation studies to date indicate that accuracy is high (r^2 = .996) (Bracco et al. 1983, Walsberg 1988, Roby 1991b). The SA-3000 TOBEC analyzer can be used in the field and powered from a 12 volt battery, so chicks can be measured for TOBEC and returned to their nest in a matter of minutes. Body mass, primary feather development, and total body fat measurements will be used to develop a condition index for each chick at 20 and 30 days post-hatch.

The effects of diet composition on the physiological condition of breeding adults will be monitored using a combination of direct and indirect methods. Attentiveness of adults will be monitored during the incubation period. Adults will be captured on the nest early in the chick-rearing period and body composition determined nondestructively by TOBEC analysis. Frequency of chick meal delivery and meal size will be determined during the chick-rearing period as part of diet composition studies.

Data on chick age-specific body mass, wing chord, and primary feather length will be separated by year and colony for each species, and fit to Gompertz sigmoidal growth models. Growth constants (K), inflection points (I), and asymptotes (A) of fitted curves will be statistically analyzed for significant differences among years and colonies. Lipid deposition rates from TOBEC analysis will be compared using slopes of least squares linear regression models. Gross foraging efficiency of adults will be calculated from daily energy expenditure by the following equation:

$$([M \cdot F \cdot D] + DEE) / DEE = GFE,$$

where M is average chick meal mass in grams, F is average frequency of meal delivery in meals day^{-1} $parent^{-1}$, D is energy density of chick meals in kJ/gram, DEE is adult daily energy expenditure in kJ/day, and GFE is adult gross foraging efficiency in kJ consumed/kJ expended. Daily energy expenditures of pigeon guillemots, black-legged kittiwakes, and common murres have been measured previously using the doubly-labeled water technique and are available in the published literature (Birt-Friesen et al. 1990). Net production efficiency of chicks as a function of age will be calculated by regressing the change in body mass over a 24 hour period against the mass of food consumed during the period, as determined by periodic weighing. Comparison of food conversion efficiency of chicks will provide an estimate of the relative energetic efficiency of diets composed of various forage fishes. The net production efficiency of the parent/offspring unit will be calculated for each diet and each year for both species using the equation:

$$CFCE / ([DEE \cdot 2] + [M \cdot F \cdot D]) = TNPE,$$

where CFCE is chick food conversion efficiency in grams of body mass gained per gram food ingested, TNPE is the total net production efficiency of the parent/offspring unit in grams gained by chicks per kJ of energy expended by both parents, and other variables are as described above.

C. Schedule

Field work in PWS will be conducted during the 1995, 1996, 1997, and 1998 breeding seasons. Data collection during four field seasons will be necessary in order to provide minimal information on interannual variation in diet composition and reproductive success. Guillemots and kittiwakes normally lay eggs from late May to late June and raise their young during July and August. Field crews will be set up at each of the four colonies in mid-May. Active, accessible nests of the two study species will be located and marked during late May and June, prior to hatching. Marked nests will be checked daily during the hatching period to determine hatching date, and, in the case of two-chick broods, chicks will be banded soon after hatching so that individual growth rates can be monitored throughout the nestling period. Samples of chick meals and measurements of chick feeding rates will be collected throughout the nestling period. Chicks will be monitored throughout the nestling period in order to determine growth rates, fledgling mass, fledging age, and survival until fledging.

Following the field season, chick meals will be analyzed in the lab in order to determine the taxonomic and biochemical composition of guillemot and kittiwake diets and their relationship to chick growth and survival. These analyses will be completed before the next field season in order to determine the results prior to collecting additional samples from the field. A draft annual report for this subproject will be prepared in February and a final report will be submitted in March for incorporation into a synthesis Annual Report for the Seabird/Forage Fish project in June.

Following the analysis of samples collected during the 1998 field season, data collected during the three field seasons will be analyzed for relationships between diet composition and reproductive success by May 1999. The results of these analyses of diet composition and its relation to productivity and chick growth will be prepared in manuscript form and submitted by the end of FY 1999.

D. Technical Support

Laboratory analyses of the biochemical composition and energy content of forage fishes will be conducted in the laboratory of the PI. No analyses will be subcontracted to other laboratories. No new laboratory equipment will need to be purchased for the proposed research with funds provided by the grant. A laboratory technician will be hired to help the PI and graduate research assistant with processing chick meals and diet samples, and with performing of routine laboratory analyses.

E. Location

The proposed field work will be conducted in PWS during FY 1995, with possible expansion to adjacent parts of the oil spill area in subsequent field seasons. PWS supports accessible

breeding populations of guillemots and kittiwakes that are more than adequate for the proposed research. Field work on guillemots will be conducted at breeding colonies on Naked Island and Jackpot Island. Naked Island is surrounded by a broad shallow shelf, whereas Jackpot Island is in deep water. Consequently, the foraging habitats available within foraging distance of the two colonies are markedly different.

Approximately 500 pigeon guillemots nest along the shores of Naked Isla nd (Sanger and Cody 1993), as well as smaller numbers of marbled murrelets and tufted puffins. The Naked Island base camp would offer an ideal base for field studies on guillemots (D. Irons, pers. comm.), and Naked Island supports the highest breeding densities of guillemots in PWS (Sanger and Cody 1993). In addition, Naked Island has been the site of long term studies since the early 1980s by the U.S. Fish and Wildlife Service (USFWS) on factors affecting reproductive success of pigeon guillemots in PWS (Kuletz 1983). Jackpot Island supports about 50 breeding pairs of guillemots that are nesting at extremely high densities and in unusually accessible nests (G. Sanger, D. L. Hayes, pers. comm.). Additional guillemot nests will be located and monitored adjacent to Jackpot Island in Icy Bay. Both Naked Island and Jackpot Island were the site of intensive studies of guillemot nesting success during the 1994 field season and have been selected for continued studies (BPD 95163F) as part of the Seabirds/Forage Fish project (D. L. Hayes, pers. comm.).

Field work on kittiwakes in PWS will be conducted at two breeding colonies, one at Shoup Bay (off Valdez Arm) which supports approximately 400 breeding pairs of black-legged kittiwakes and another at Eleanor Island (adjacent to Naked Island) which supports about 550 breeding pairs. The Shoup Bay colony is the site of continuing long-term studies of kittiwake nesting ecology in PWS by the USFWS and Eleanor Island has been selected as a site for intensive study for comparison purposes (D. Irons, pers. comm.). Both colonies include large numbers of readily accessible nests.

The at-sea foraging distribution of pigeon guillemots near Naked Island and Jackpot Island has been the subject of previous study (Sanger and Cody 1993), as has the species composition of the diet (Kuletz 1983). Kittiwake foraging distribution and reproductive success has been monitored at the Shoup Bay colony for several years (D. Irons, pers. comm.). In addition, subproject 95163B will provide data on the distribution of foraging kittiwakes and guillemots in the vicinity of the four study colonies during the chick-rearing period. A field camp operated by the USFWS is available for field workers on Naked Island and at Shoup Bay and is within walking distance or short boat ride of colonies where adequate numbers of accessible guillemot and kittiwake nests are available.

PROJECT IMPLEMENTATION

The proposed research will be implemented by the University of Alaska Fairbanks, closely

coordinated with and in cooperation with USFWS biologists with expertise on the proposed study species in the proposed study area. The PI (Daniel D. Roby) has extensive experience with studies of the reproductive energetics of high latitude seabirds and the relationship between diet composition and productivity. The PI currently has in his laboratory the analytical equipment necessary to accomplish the proposed laboratory analyses and is familiar with the relevant analytical procedures. To the PI's knowledge, the expertise and equipment necessary for the proposed research are not available within the federal and state agencies that compose the Trustees Council. The PI will be assisted by a Graduate Research Assistant (Ph.D. candidate), Field Technician, and undergraduate field assistant who will be carefully selected from the applicant pool as qualified to participate in the proposed research.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The research described in this proposal is a subproject within the Seabird/Forage Fish project (95163A-I) and dove-tails nicely with new and continuing research to assess factors limiting recovery of seabird populations damaged by EVOS. It is also relevant to efforts toward developing seabird models as upper trophic level sentinels of changes in the availability of forage fish, such as sand lance, juvenile pollock, herring, capelin, and smelt. The proposed research approach utilizes prey composition, reproduction rates, and energetics models to help identify and quantify the present level of forage fish availability within the PWS ecosystem. This approach is necessary because evaluation of the stocks of various forage fishes is extremely complex due to temporal and spatial variability and unpredictability in the distribution of forage fish in PWS.

Studies of foraging, reproduction, and population recovery following the EVOS are on-going for pigeon guillemots, common murres, and marbled murrelets. Black-legged kittiwakes are currently being used as indicators of ecosystem function and health within PWS. This proposal complements and enhances other proposed studies on pigeon guillemots and black-legged kittiwakes without duplication of effort. The PI on the present proposal has been and will continue to work closely with Dr. David Irons (PI on subproject 95163E [formerly 95033] "Kittiwakes as Indicators of Forage Fish Availability) and D. Lindsey Hayes (PI on subproject 95163F [formerly 95173] "Factors Affecting Recovery of PWS Pigeon Guillemot Populations") in developing protocols for collecting field data on kittiwakes and guillemots so as to minimize project cost and maximize data acquisition. Dr. Irons and Mr. Hayes are both with the Migratory Bird Branch, USFWS. Dr. Irons has had extensive experience working in the field with both guillemots and kittiwakes nesting in PWS, and is project leader for on-going studies of the reproductive success and status of these two species in PWS. Mr. Hayes was in charge of the field crew working on pigeon guillemots at Naked Island during the 1994 breeding season and has extensive field experience with nesting guillemots. Close coordination with Dr. Irons' and Mr. Hayes' research teams will be essential for the success of the proposed research.

Subprojects 95163E, 95163F, and the present subproject (95163G) all require information on chick feeding rates, chick meal size, and taxonomic composition of chick diets in order to meet their objectives. Collecting these data is extremely labor intensive and the cooperation of these three subprojects in collecting these data will greatly enhance sample sizes. The three subprojects also require data on chick growth rates (body mass and flight feather development), nestling survival, body composition and mass of fledglings, and fledging age. Again, cooperation and coordination between these three subprojects will greatly enhance sample sizes and the power of statistical tests and inferences. The field crews for the three subprojects will work together to insure that data collection methods and procedures are consistent. In addition, the PIs for subprojects 95163E (D. Irons) and 95163F (D. L. Hayes) have agreed to assist this subproject in collecting food items for analysis of biochemical composition of the diet and in collecting data on the body composition of adults and chicks.

Additional cooperators include Dr. Scott Hatch (PI for subproject 95163D [formerly 95019] "Distribution and Abundance of Forage Fish as Indicated by Puffin Diet Sampling"). Dr. Hatch's subproject will collect forage fish from breeding tufted puffins on Naked Island and nearby Smith Island. Considerable overlap between diets of tufted puffins, black-legged kittiwakes, and pigeon guillemots is expected, so forage fish samples collected as part of subproject 95163D will be extremely useful for determining the biochemical composition and energy density of guillemot and kittiwake diets. Kathy Kuletz (PI for project 95031, "Reproductive Success as a Factor Affecting Recovery of Murrelets in PWS") will be working on Naked Island and may collect data on diet composition of breeding marbled murrelets in the course of her studies. These data will be extremely useful for comparison with diet composition of guillemots and kittiwakes.

Subproject 95163H "Proximate Composition and Energetic Content of Selected Forage Fish Species in PWS" (PI Dr. Graham Worthy) will assess the quality of various forage fish that are major prey for seabirds and marine mammals. Dr. Worthy's study will use fish specimens collected during shipboard surveys throughout the year to provide background data for the entire Seabird/Forage Fish project, including this subproject. Comparison between the proximate composition of forage fishes collected at sea and those fed to seabird nestlings will provide a valuable means of assessing the role of prey selection for enhancing the quality of seabird diets. Sample treatment and proximate analysis procedures will be consistent between subprojects 95163G and 95163H so that the results are comparable. These two projects will be coordinated so as not to duplicate efforts to obtain data on the proximate composition of forage fish used by guillemots and kittiwakes during the breeding season.

In order to understand dietary factors responsible for poor reproductive performance of seabirds in PWS, it is essential to conduct simultaneous shipboard work (hydroacoustic surveys in conjunction with net sampling) to assess the distribution, abundance, and species composition of forage fish in seabird foraging areas. That research was recently funded by the Trustees Council (project 94163) and the continuation of this project (subproject 95163A)

will be invaluable for interpretation of data on diets collected as part of the present proposal. In addition, the integrated studies that comprise the SEA Program (95320A-Y) will provide an important foundation for understanding ecosystem function in PWS as it relates to Seabird/Forage Fish interactions.

FY 95 BUDGET ($K)

Personnel	45.7
Travel	4.7
Contractual	24.6
Commodities	17.8
Equipment	0.0
Indirect Costs	39.2
Subtotal	132.0
Gen. Admin.	8.6
Total	140.6

LITERATURE CITED

Asbirk, S. 1979. The adaptive significance of the reproductive pattern in the black guillemot, *Cepphus grylle*. Vidensk. Meddr. dansk naturh. Foren. 141:29-80.

Ashmole, N. P. 1971. Seabird ecology and the marine environment. Pp. 223-286 in D. S. Farner and J. R. King (eds.), Avian Biology, Vol. 1. Academic Press, New York.

Barrett, R. T., T. Anker-Nilssen, F. Rikardsen, K. Valde, N. Rov, and W. Vader. 1987. The food, growth and fledging success of Norwegian puffin chicks *Fratercula arctica* in 1980-1983. Ornis Scand. 18: 73-83.

Benson, A. A., R. F. Lee, and J. C. Nevenzel. 1972. Wax esters: major marine metabolic energy sources. Pp. 175-187 in I. Ganguly and R. M. S. Smellie (eds.), Current Trends in the Biochemistry of Lipids. Biochem. Soc. Symp. No. 35. Academic Press, New York.

Bligh, E. G., and W. J. Dyer. 1959. A rapid method of total lipid extraction and purification. Can. J. Biochem. Physiol. 37: 911-917.

Bracco, E.F., M. Yang, K. Segal, S.A. Hasim, and T. B. Van Itallie. 1983. A new method for determining body composition in the live rat. Proc. Soc. Exp. Bio. Med. 174: 143-148.

Clarke, A. 1980. The biochemical composition of krill, Euphausia superba Dana, from South Georgia. J. exp. mar. Biol. Ecol. 43: 221-236.

Clarke, A. 1984. The lipid content and composition of some Antarctic macrozooplankton. Br. Antarct. Surv. Bull. No. 63: 57-70.

Clarke, A. *in press*. Seabirds. in R. G. Ackman (ed.), Marine Biogenic Lipids. Chemical Rubber Co.

Dragoo, D. E. 1991. Food habits and productivity of kittiwakes and murres at St. George Island, Alaska. Unpubl. M.S. thesis, University of Alaska, Fairbanks. 104 pp.

Drent, R. H. 1965. Breeding biology of the pigeon guillemot, *Cepphus columba*. Ardea 53:99-159.

Ellis, H. I. 1984. Energetics of free-ranging seabirds. Pp. 203-234 in G. C. Whittow and H. Rahn (eds.), Seabird Energetics. Plenum Press, New York.

Flint, E. N., G. L. Hunt, Jr., and M. A. Rubega. 1990. Time allocation and field metabolic rate in two sympatric kittiwake species. Acta XX Congressus Internationalis Ornithologici, Supplement, pp. 426-427. (Abstract).

Hall, K. J. 1983. Physiology of the digestive tract. Pp. 31-49 in B. M. Freeman (ed.), Physiology and Biochemistry of the Domestic Fowl, Vol. 4. Academic Press, London.

Harrison, G. G. 1987. The measurement of total body electrical conductivity. Human Biol. 59: 311-317.

Harrison, G. G., and T. B. Van Itallie. 1982. Estimation of body composition: a new approach based on electromagnetic principles. Am. J. Clin. Nutri. 35: 1176-1179.

Hatch, S. A., G. V. Byrd, D. B. Irons, and G. L. Hunt, Jr. In press. Status and ecology of kittiwakes (*Rissa tridactyla* and *R. brevirostris*) in the North Pacific. In The status, ecology and conservation of marine birds of the North Pacific, K. Vermeer, K. T. Briggs, K. H. Morgan, and D. Siegel-Causey (eds.). Can. Wildl. Serv. Spec. Pub., Ottawa.

Hislop, J. R. G., M. P. Harris, and J. G. M. Smith. 1991. Variation in the calorific value and total energy content of the lesser sandeel (*Ammodytes marinus*) and other fish preyed on by seabirds. J. Zool., Lond. 224: 501-517.

Hunt, G. L., Jr., B. Burgeson, and G. A. Sanger. 1981a. Feeding ecology of seabirds in the eastern Bering Sea. Pp. 629-647 in D. W. Wood and J. A. Calder (eds.), The eastern Bering Sea shelf: oceanography and resources. Vol. 1, U.S. Gov. Printing Office, Washington, D.C.

Hunt, G. L., Jr., Z. Eppley, B. Burgeson, and R. Squibb. 1981b. Reproductive ecology, foods and foraging areas of seabirds nesting on the Pribilof Islands, 1975-1979. Environ.

Assess. Alaskan Contin. Shelf, Ann. Rep. Princ. Investig. NOAA Environ. Res Lab., Boulder, CO 12: 1-258.

Klosiewski, S. P., and K. K. Laing. ms. Marine bird populations of Prince William Sound, Alaska, before and after the *Exxon Valdez* oil spill. Bird Study No. 2. Final Report. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska.

Kuletz, K. J. 1983. Mechanisms and consequences of foraging behavior in a population of breeding pigeon guillemots. M.S. Thesis, Univ. of California, Irvine. 79 pp.

Lee, R. F., J. Hirota, J. C. Nevenzel, R. Sauerheber, A. A. Benson, and A. Lewis. 1972. Lipids in the marine environment. Calif. Mar. Res. Comm., CalCOFI Rep. 16: 95-102.

Massias, A., and P. H. Becker. 1990. Nutritive value of food and growth in common tern *Sterna hirundo* chicks. Ornis Scand. 21: 187-194.

Montevecchi, W. A., and J. Piatt. 1984. Composition and energy contents of mature inshore spawning capelin (*Mallotus villosus*): implications for seabird predators. Comp. Biochem. Physiol. 78A: 15-20.

Montevecchi, W. A., R. E. Ricklefs, I. R. Kirkham, and D. Gabaldon. 1984. Growth energetics of nestling gannets (*Sula bassanus*). Auk 101: 334-341.

Nevenzel, J. C. 1970. Occurrence, function and biosynthesis of wax esters in marine organisms. Lipids 5: 308-319.

Oakley, K. 1981. Determinants of the population size and distribution of the pigeon guillemot (*Cepphus columba*) at Naked Island, Prince William Sound, Alaska. M.S. Thesis, Univ. of Alaska, Fairbanks. 65 pp.

Oakley, K., and K. J. Kuletz. ms. Population, reproduction and foraging ecology of pigeon guillemots at Naked Island, Prince William Sound, Alaska, before and after the *Exxon Valdez* oil spill. Bird Study Number 9. Final Report. U.S. Fish and Wildlife Service, Migratory Bird Management, Anchorage, Alaska.

Obst, B. S., K. A. Nagy, and R. E. Ricklefs. 1987. Energy utilization in Wilson's Storm-petrel (*Oceanites oceanicus*). Physiol. Zool.

Pethig, R. 1979. Dielectric and electronic properties of biological materials. Wiley, Chichester.

Presta, E., K. R. Segal, B. Gutin, C. G. Harrison, and T. B. Van Itallie. 1983a. Comparison in man of total body electrical conductivity and lean body mass derived from body density: validation of a new body composition method. Metabolism 32: 534-537.

Presta, E., J. Wang, G. C. Harrison, P. Bjomtorp, W. H. Harter, and T. B. Van Itallie. 1983b. Measurement of total body electrical conductivity: a new method for estimation of body composition. Am. J. Clin. Nutr. 37: 735-739.

Prince, P. A., and C. Ricketts. 1981. Relationships between food supply and growth in albatrosses: an interspecies chick fostering experiment. Ornis Scand. 12: 207-210.

Ricklefs, R. E. 1974. Energetics of reproduction in birds. Pp. 152-292 in R. A. Paynter (ed.), Avian Energetics. Publ. Nuttall Ornithol. Club, No. 15.

Ricklefs, R. E. 1979. Adaptation, constraint, and compromise in avian postnatal development. Biol. Rev. 54: 269-290.

Ricklefs, R. E. 1983a. Some considerations on the reproductive energetics of pelagic seabirds. Studies in Avian Biology No. 8: 84-94.

Ricklefs, R. E. 1983b. Avian postnatal development. Pp. 1-83 in D. S. Farner, J. R. King, and K. C. Parkes (eds.), Avian Biology, Vol. 7. Academic Press, New York.

Ricklefs, R. E. 1984a. Meal sizes and feeding rates of Christmas Shearwaters and Phoenix Petrels on Christmas Island, Central Pacific Ocean. Ornis Scand. 15: 16-22.

Ricklefs, R. E., S. C. White, and J. Cullen. 1980a. Postnatal development of Leach's Storm-petrel. Auk 97: 768-781.

Ricklefs, R. E., S. C. White, and J. Cullen. 1980b. Energetics of postnatal growth in Leach's Storm-petrel. Auk 97: 566-575.

Ricklefs, R. E., C. H. Day, C. E. Huntington and J. B. Williams. 1985. Variability in feeding rate and meal size of Leach's Storm-petrel at Kent Island, New Brunswick. J. Anim. Ecol. 54: 883-898.

Ricklefs, R. E., A. R. Place, and D. J. Anderson. 1987. An experimental investigation of the influence of diet quality on growth in Leach's Storm-Petrel. Am. Nat. 130: 300-305.

Roby, D. D. 1989. Chick feeding in the diving petrels Pelecanoides georgicus and P. urinatrix exsul. Antarctic Science 1: .

Roby, D. D. 1991a. Diet and postnatal energetics in two convergent taxa of plankton-feeding seabirds. Auk 108: 131-146.

Roby, D. D. 1991b. A comparison of two noninvasive techniques for measuring total body lipid in live birds. Auk 108: 509-518.

Roby, D. D., and R. E. Ricklefs. 1986. Energy expenditure in adult Least Auklets and diving petrels during the chick-rearing period. Physiol. Zool. 59: 661- 678.

Roby, D. D., A. R. Place, and R. E. Ricklefs. 1986. Assimilation and deposition of wax esters in planktivorous seabirds. J. Exp. Zool. 238: 29-41.

Roby, D. D., K. L. Brink, and A. R. Place. 1989. Relative passage rates of lipid and aqueous digesta in the formation of stomach oils. Auk 106: 303-313.

Sanger, G. A., and M. B. Cody. 1993. Survey of Pigeon Guillemot colonies in Prince William Sound, Alaska. Draft Final Report, Restoration Project 93034, U.S. Fish and Wildlife Service, Anchorage, AK.

Sargent, J. R. 1976. The structure, metabolism and function of lipids in marine organisms. Pp. 149-212 in D. C. Malins and J. R. Sargent (eds.), Biochemical and Biophysical Perspectives in Marine Biology, Vol. 3. Academic Press, London.

Shea, R. E., and R. E. Ricklefs. 1985. An experimental test of the idea that food supply limits growth in a tropical pelagic seabird. Am. Nat. 126: 116-122.

Simons, T. R., and G. C. Whittow. 1984. Energetics of breeding Dark-rumped Petrels. Pp. 159-181 in G. C. Whittow and H. Rahn (eds.), Seabird Energetics. Plenum Press, New York.

Sowls, A. L., S. A. Hatch, and C. J. Lensink. 1978. Catalog of Alaskan seabird colonies. U.S. Dept. Interior, Fish and Wildlife Service, FWS/OBS-78/78.

Springer, A. M. 1992. A review: walleye pollock in the North Pacific--how much difference do they really make? Fish. Oceanogr. 1: 80-96.

Springer, A. M., and G. V. Byrd. 1988. Seabird dependence on walleye pollock in the southeastern Bering Sea. Pp. 667-677 in International symposium on the biology and management of walleye pollock. Lowell Wakefield Fish. Symp. 7, Alaska Sea Grant Rep. 89-1.

Van Loan, M., and P. Mayclin. 1987. A new TOBEC instrument and procedure for the assessment of body composition: use of Fourier coefficients to predict lean body mass and total body water. Am. J. Clin. Nutr. 45: 131-137.

Walsberg, G. E. 1983. Avian ecological energetics. Pp. 161-220 in D. S. Farner and J. R. King (eds.), Avian biology, Vol. 7. Academic Press, New York.

Walsberg, G. E. 1988. Evaluation of a nondestructive method for determining fat stores in small birds and mammals. Physiol. Zool. 61: 153-159.

Wanless, S., and M. P. Harris. 1992. Activity budgets, diet and breeding success of kittiwakes *Rissa tridactyla* on the Isle of May. Bird-Study 39: 145-154.

Proximate Composition and Energetic Context of Selected Forage Fish Species in Prince William Sound

Project Number:	95163H (formerly BAA-120)
Restoration Category:	Research (new)
Proposed By:	Physiological Ecology Research Laboratory, Marine Mammal Research Program, Texas A&M University
Lead Trustee Agency:	NOAA
Cost FY 95:	$43,000
Cost FY 96:	$35,000
Total Cost:	Unknown
Duration:	4 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Multiple resources

INTRODUCTION

As a result of damage assessment studies initiated after the *T/V Exxon Valdez* struck Bligh Reef in March, 1989, it was noted that several pelagic-feeding marine mammals and seabirds found in Prince William Sound (PWS) were apparently not recovering back to predisturbance population levels. This lack of recovery may be due to a number of factors, including possible food limitations. Food limitations have been suggested to be a problem for a variety of species which are found throughout the Bering Sea and Gulf of Alaska. While cause-effect relationships are difficult to demonstrate, changes in the energetic value of prey species can be quantified and these values used in the interpretation of energy availability to the impacted species. In PWS, two marine mammal species, harbor seals and sea otters, and several seabird species (common murre, harlequin duck, marbled murrelet, and pigeon guillemot) have been impacted and are not recovering. Others, such as killer whales, are recovering but may be indirectly inhibiting the recovery of other species if food competition is a problem.

There is increasing interest in the use of energetic models to study interactions between marine mammals or seabirds and their prey species. Often these models are based upon energy transfer between predator and prey. Although these models require information on

the energy context or proximate composition of these species, few data are available. Those data which have been published have limited application due to the inherent seasonal and annual variability in the value of the prey. The goal of this proposed subproject is to assess on a seasonal and annual basis, the value of the major prey species that would be of significance to the mammalian and avian predators listed above. These data will allow for the development of models that may yield reasons for the lack of recovery of these species.

NEED FOR THE PROJECT

This subproject will provide the background data necessary for future studies of food web dynamics and ecology of many species of fish, birds, and mammals of PWS. In any long-term study of foraging ecology, especially those investigating the recovery of impacted species, knowledge of prey species composition and energetic value is critical in the interpretation of consumption rates and therefore the impact of consumer species upon prey species stocks. Compositional analysis will also yield important information on the general quality of the environment by assessing the condition of important prey species.

PROJECT DESIGN

A. Objectives

The objectives of this subproject are to assess the seasonal and annual changes in the proximate composition of the major forage fish species in PWS. Data on the composition and energetic value of prey species for marine mammals and seabirds are very limited. Most data that are available are for commercial species that are consumed by humans. These data are further limited, in their ecological application, because they usually only analyze the edible fillets that people consume. Another major limitation in the database relates to the lack of an appreciation of the magnitude of seasonal variability which occurs. For example, herring can vary from as little as 3% lipid to as much as 22% lipid seasonally. Knowing the energy content and composition of these species will allow us to further enhance our understanding of the energetic and physiological ecology of the major consumer species in the PWS.

B. Methods

Species that should be collected are listed in Table 1. Samples should be frozen immediately after collection and be representative of the size classes which are known to be consumed by the consumer species in question.

All analytical techniques are described in detail in Worthy and Lavigne (1983) and Hislop et al. (1991). Analysis will be performed on freeze-dried, ground fish and will include

determinations of water content, total lipid content, total protein content, ash content, and energy density. Initially, wet mass, sex, and length of each individual specimen will be recorded. Specimens would then be combined, ground, and homogenized prior to freeze-drying. Water content will be determined gravimetrically by lyophilization of ground, homogenized prey until constant mass has been obtained. This will be accomplished using a LabConco Lyophilizer over a period of 4-5 days. Once the samples are dried, they are finely ground using a Spex 8000 Mixer/mill. This ground material will be used in all subsequent analyses and will be available for other investigators to use for future studies.

Lipid content will be measured gravimetrically by Soxhlet extraction using petroleum ether as the solvent. Protein content will be assessed using a modified Kjeldhal analysis and ash content will be determined by ashing at 550°C for 2 h in an ashing oven. Ground lyophilized samples will be analyzed for energy content by means of a Parr adiabatic bomb calorimeter.

C. Schedule

It is suggested that sampling be conducted a minimum of two seasons per year, when maximum productivity is occurring. If samples can be opportunistically obtained on a more regular basis, then a more detailed assessment of seasonal changes can be undertaken.

D. Technical Support

Collections will be done during Seabird/Forage Fish and SEA project cruises, charter cruises, and through the purchase of fish from local fishermen. All of the required equipment and expertise for this project are on-site at Texas A&M University - Galveston. This includes all of the specialized equipment required for the composition and energetics analysis, as well as archival capabilities for samples and the computer related software for full statistical analysis of the data.

E. Location

Collections will take place throughout PWS and surrounding waters.

PROJECT IMPLEMENTATION

This proposal is being submitted by the Physiological Ecology Research Laboratory (PERL) of the Marine Mammal Research Program (MMRP) of Texas A&M University - Galveston. The PERL is already collaborating with National Marine Fisheries Service, National Marine Mammal Laboratory, on two other projects related to the ecology of killer whales and use of stable isotope tracers in PWS. All of the data obtained in the present subproject will also be incorporated into the Integrative Marine Mammal Ecosystem Program.

The PERL has 20 years of combined experience in the analysis of prey species of marine mammals for their composition and energetic value. The ultimate aim of the PERL is to develop a library of prey species samples which could be made available to researchers for future analyses, as well as to make available data on long-term changes in prey species energetic values. The PERL currently is involved in similar projects in California, Texas, Florida, and eastern Canada.

COORDINATION OF INTEGRATED RESEARCH EFFORT

Collection of prey species will be undertaken during cruises by Seabird/Forage Fish and SEA projects. Additionally dedicated cruises may be required for the collection of certain species. Samples will be archived for potential future use by other investigators interested in this area. This subproject is an integral part of the Seabird/Forage Fish project and will provide key information to the synthesis report. Data collected will be used by the Seabird Energetics subproject (95163G) and subsequently by Puffins as Samplers (95163D), Kittiwakes as Indicators (95163C), and Pigeon Guillemot Recovery (95163F) components. To facilitate access to project data, the information collected from this subproject will be incorporated into a data base managed by the Trustee Council and by SEA.

FY 95 BUDGET ($K)

Personnel	20.5
Travel	3.0
Contractual	0.0
Commodities	3.5
Equipment	1.0
Indirect Costs	11.9
Subtotal	39.9
Gen. Admin.	3.1
Total	43.0

Table 1. Forage fish species of significance in the PWS System that are proposed to be studied for composition and energetic value in the present study. Suggested species were determined by assessing their importance to the various seabirds and marine mammals that are found in PWS. Some species are of importance only to the larger species such as killer whales (*Orcinus orca*).

Pacific herring	*Clupea harengus pallasi*
Rockfish	*Sebastes sp.*
Cutthroat trout	*Salmo clarkii*
Capelin	*Mallotus villosus*
Rainbow smelt	*Osmerus mordax*
Sand lance	*Ammodytes hexapterus*
Eulachon	*Thaleichthys pacificus*
Pacific cod	*Gadus macrocephalus*
Walleye pollock	*Theragra chalcogramma*
Sablefish	*Anopoploma fimbria*
Pacific sandfish	*Trichodon trichodon*
Pink salmon	*Onchorhynchus gorbuscha*
Sockeye salmon	*O. nerka*
King salmon	*O. tshawytscha*
Silver salmon	*O. kisutch*
Chum salmon	*O. iceta*

Seabird/Forage Fish - Program Management and Integration

Project Number:	95163I
Restoration Category:	Research (new)
Proposed By:	DOI, NOAA, ADFG
Cost FY95:	$80,700
Cost FY96:	$105,000
Total Cost:	Unknown
Duration:	6 years
Geographic Area:	Prince William Sound
Injured Resource/Service:	Multiple resources

INTRODUCTION

This component of the Seabird/Forage Fish project (95163A-I) will provide for scientific oversight, coordination, performance tracking, and integration of results. The suggested approach to program management employs elements that have been used effectively in other large, multidisciplinary programs for ecosystem assessment.

NEED FOR THE PROJECT

The Seabird/Forage Fish project, in its initial form and likely evolution, will comprise a number of interacting components involving specialists from various agencies, universities, and private organizations. To ensure that a cooperative and efficient research effort is achieved, it is essential that a program management plan be implemented to address such issues as team organization, scientific planning, scheduling and reporting, coordination between investigators and other existing programs and projects, data management, and quality assurance. This proposal recognizes that such functions cannot be solely vested in the individual Principal Investigators, that a responsible individual or group must be identified and dedicated to each of the management tasks, and that effective program management cannot be achieved at zero cost.

PROJECT DESIGN

A. Objective

The objective of program management and integration is to ensure a coordinated and scientifically productive research effort in support of restoration goals for seabirds.

B. Methods

The investigative team proposes to enlist one full-time individual (Program Coordinator) to implement and adaptively refine a management plan for seabird and forage fish investigations. The person recruited will possess a reasonable level of technical competence in marine ecology, fisheries, and/or avian science, as well as demonstrated skill in program organization and management. Duties of the Program Coordinator include (but are not limited to) the following: (1) coordinate activities among subprojects (methods, timing, and location of data collection, logistics, and contingency planning), (2) coordinate activities and facilitate data sharing with SEA investigations (95320), (3) facilitate communication among agencies and between this project and the oil spill restoration office (Executive Director, Chief Scientist, and staff), (4) schedule performance milestones for individual projects and assess success in meeting those milestones, (5) conduct quarterly meetings of the Principal Investigators, (6) prepare an annual synthesis report of forage fish and seabird projects and make an oral presentation at the annual science workshop, (7) provide scientific oversight and quality assurance by enlisting the services of a Technical Steering Committee (see below) and a qualified biometrician during project planning and review, and (8) explore opportunities for data management and system modelling, emphasizing cooperation with related efforts such as the Information Management System project (95089) and the SEADATA project (95320J).

The team further proposes to establish a three-member Technical Steering Committee with duties comparable to those of a project Chief Scientist. The Steering Committee will consist of individuals with expertise and professional stature in the relevant sciences (marine ecology, fisheries, avian biology, and population dynamics) who are not actively engaged in the field research program. The Technical Steering Committee will advise primarily on matters of overall scientific direction, but may also assist in defining specific research objectives and procedures.

C. Schedule

Annual scheduling to accomplish program management tasks will be the responsibility of the Program Coordinator. A reduced funding level is proposed for FY 95, reflecting the likelihood that this position will not be filled before March during the first year of the Seabird/Forage Fish study.

D. Technical Support

It is not expected that the Program Coordinator will have the skills and time to perform all of the identified tasks single-handedly. Rather, the position will come with a limited operating budget (ca. $40K) for purposes of travel and for contracting as needed the services of the Technical Steering Committee, a biometrician, technical writer, modeler, or data management specialist.

E. Location

Not applicable.

PROJECT IMPLEMENTATION

The position will most likely be filled through a personal services contract, as opposed to direct hire. Selection of the Program Coordinator and members of the Technical Steering Committee will be subject to approval by the Principal Investigators participating in the project.

COORDINATION OF INTEGRATED RESEARCH EFFORT

The central mission of this subproject is coordination of seabird and forage fish investigations, both within the parent Seabird/Forage Fish project (95163A-I) and between this project and other programs funded by the Trustee Council.

FY 95 BUDGET ($K)

Personnel	10.0
Travel	5.0
Contractual	60.0
Commodities	0.0
Equipment	0.0
Subtotal	75.0
Gen. Admin.	5.7
Total	80.7

APPLIED
marine
SCIENCES

October 3, 1994

TO: Rebecca Williams

FROM: Andy Gunther

CC: Molly McCammon
Bob Spies

RE: Peer review of revised Forage Fish Proposal

Thank you for offering to distribute the revised forage fish package for peer review. Your efforts should save us an extra day on our rather tight schedule for obtaining review of the revised forage fish package.

It is my understanding that on October 5th David Irons will deliver a copy of the revised package to you. I believe the new title will be "Marine Bird Forage Fish Interactions." Attached you will find three federal express labels already made out for Stan Senner, Chris Haney, and Alan Springer, who will be reviewing the revised package for us. Please make copies of the document Dave Irons provides and deliver it to the reviewers by priority overnight service with the memos I have provided (also attached).

I will be in Cordova on Wednesday and Thursday, October 5th and 6th. Please contact me if you have any questions. I'm staying at the Reluctant Fisherman, and will be at the Masonic Hall or the Prince William Sound Science Center during the days. There is a phone in the Masonic Hall, but I don't know what the number is yet. I'm sure the Science Center will have it if you need to speak to me.

Rebecca -
This is the packet
& Fed Ex'd to:
S. Senner
C. Haney
A. Springer
on Wed 10/5/94
T.

DHL:
George Rose per
Andy Gunther (Cordova
(P. Peterson Cc. Cook Hotel)

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 "G" Street, Anchorage, AK 99501
Phone: (907) 278-8012 Fax: (907) 276-7178

MEMORANDUM

TO: Trustee Council Principal Investigators

VIA: Agency Liaisons

FROM: James R. Ayers
Executive Director

DATE: October 4, 1994

RE: Completion of the PICES Survey

Attached you will find a survey form from GLOBEC PICES (North Pacific Marine Science Organization) that I am requesting you to complete and return the form to Brenda Norcross. PICES is an international treaty signed by the United States, Canada, Japan, China, and soon to be joined by Russia. Working Group 3, of which Brenda is a member, focuses on research of coastal pelagic fishes within the PICES region (north of 40° N).

The objective of this survey is to compile and maintain an international list of researchers who are interested in small coastal pelagic fishes. The focus of the working group does not include salmon, as that is covered by a separate group. However, for those of you studying juvenile salmon within the coastal ecosystem, it would be appropriate to have your interests included here too.

Please send your completed forms to Brenda Norcross at the address on the attached form.

JRA/mir

Attachment

cc: Brenda Norcross

C:\WPDOCS\TCPRNINV.MEM

SURVEY BY PICES WORKING GROUP 3
of
Researchers Who Study Coastal Pelagic Fishes

Instructions:

Please complete a separate form for each key researcher in your country.

Return all completed forms to:

Dr. Brenda L. Norcross
Institute of Marine Science
University of Alaska Fairbanks
Fairbanks, AK 99775-7220 USA

or send via internet to: NORCROSS@IMS.ALASKA.EDU

Include the following on the reverse side:

NAME of key person engaged in research, include title by which to address this person.

Complete **ADDRESS** at which to send correspondance.

AFFILIATION of government agency or unversity with which researcher is associated.

PHONE and **FAX** at which this researcher can be reached.

EMAIL address at which this researcher can be reached, include system, e.g., Internet, Omnet.

COUNTRY and **LOCATION WITHIN COUNTRY** where research is focused, e.g., USA, Gulf of Alaska; Japan, Funka Bay.

SPECIES STUDIED (give scientific name and common name) by researcher, i.e., anchovy, sardine, jack mackerel, scomber, herring, pollock, hake.

PRESENT RESEARCH INTERESTS of project in which researcher is currently engaged, e.g., acoustics, age, distribution, energetics, fecundity, food habits, forecasting fish availability, growth, juveniles, larval fish, modelling, nutrition, oceanography, spawning, stock assessment, trophodynamics (including pelagics as forage).

BROAD TOPICS OF INTEREST of researcher even though not presently actively engaged in this aspect of research. See suggested areas listed above.

SURVEY BY PICES WORKING GROUP 3

of

Researchers Who Study Coastal Pelagic Fishes

Title/Name _____

Mailing Address _____

_____

_____

_____

Affiliation/Agency _____

Phone _____

FAX _____

Email Address _____

Country of study _____

Location of study _____

Species studied _____

Present research interests _____

_____

Broad topics of interest _____

_____

Exxon Valdez Oil Spill Trustee Council
Restoration Office
645 "G" Street, Anchorage, AK 99501
Phone: (907) 278-8012 Fax: (907) 276-7178

October 4, 1994

Mr. Leonard Schwartz
Alaska Department of Fish & Game
P.O. Box 669
Cordova, AK 99574

Dear Mr. Schwartz:

It is my understanding that you contacted the Anchorage Restoration Office late in 1993 regarding Habitat Protection and Karluk IRA Tribal Council. You spoke with Rebecca Williams, who then passed your concerns on to me and Carol Fries of the Alaska Department of Natural Resources.

Carol Fries sent a landowner letter to Alicia Reft, President of Karluk IRA Tribal Council at P.O. Box 22, Karluk, Alaska 99608, on January 10, 1994. There was no response to this letter, so another was sent and signed for by Beverly Charliago on June 16, 1994. Again, there was no response to this second letter. Rebecca Williams tried twice to contact you to inform you that a landowner letter was being sent and was unable to get through to you.

If you have any other concerns or questions, please don't hesitate to contact me at the number listed above or at 586-7238.

I would appreciate any assistance you could provide in contacting Alicia Reft.

Sincerely,

James R. Ayers
Executive Director

jra/raw

D:\WPWIN60\WPDOCS\SCHWARTZ.REB

To: Jim Ayers
FAX: 586-7589
From: Carol Fries
Phone: 762-2483
Date: June 2, 1994
Subject: Karluk Village Tribal Council

A landowner letter was sent to Alicia Reft, President of Karluk IRA Tribal Council at P.O. Box 22, Karluk, AK 99608 on January 10, 1994, in response to a request by Lin Schwartz of ADF&G. Mr. Schwartz was concerned that Karluk had not been properly notified by Koniag, the Native Corporation about the Trustee Council Habitat Protection Process. He felt that since the initial mailout, the political situation within the Native Corporation had changed. Since that time, Karluk had regained ownership over the bottom 5 miles of Karluk River and Karluk Lagoon. He felt that they might be interested in participating in the Habitat Protection process. However, we never received a response from Karluk and attempts by Rebecca to contact Mr. Schwartz to follow up on this were not successful. He did not return her calls.

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 G Street, Suite 402, Anchorage, Alaska 99501
Phone: (907) 278-8012 Fax: (907) 276-7178

June 10, 1994

Alicia Reft, President
Karluk IRA Tribal Council
P.O. Box 22
Karluk, AK 99608

Dear Ms. Reft;

The settlement of federal and state lawsuits related to the *Exxon Valdez* Oil Spill resulted in funds being made available for restoration of resources and services injured by the spill. The *Exxon Valdez* Oil Spill Trustee Council is responsible for managing these funds and deciding on what projects to fund to accomplish restoration.

Protection of habitat is expected to be an important element of restoration. Acquisition of title to land or acquisition of other property rights are important protection tools. Lands may be acquired or otherwise protected if it can be demonstrated that such actions contribute to the restoration of resources or services injured by the spill.

The Trustee Council is identifying lands that are important to accomplish restoration objectives. It is neither necessary nor possible to protect all habitats that would contribute to restoration of injured resources and services. We are sending this letter to a large number of owners of property rights that are potentially valuable to our restoration efforts. You have been identified as a possible owner of such property. We would like to know if you are interested in participating in our identification and analysis process. This process locates, characterizes and evaluates privately owned habitat (land) linked to the recovery or replacement of resources and services (human uses) injured by the Exxon Valdez Oil Spill.

Your response is sought for informational purposes only and is in no way binding upon you or the Trustee Council. If you indicate that you would be interested in discussions, we will contact you regarding analysis of your property and/or property rights.

Please respond on the enclosed form and return it to us. Until we receive your response we are not able to consider you a willing participant. We appreciate your consideration.

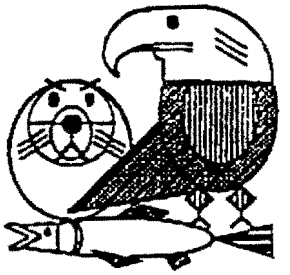
Sincerely,

James Ayers
Executive Director

Enclosures

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 G Street, Suite 402, Anchorage, Alaska 99501
Phone: (907) 278-8012 Fax: (907) 276-7178



January 10, 1994

Alicia Reft, President
Karluk IRA Tribal Council
P.O. Box 22
Karluk, AK 99608

Dear Ms. Reft;

The settlement of federal and state lawsuits related to the *Exxon Valdez* Oil Spill resulted in funds being made available for restoration of resources and services injured by the spill. The *Exxon Valdez* Oil Spill Trustee Council is responsible for managing these funds and deciding on what projects to fund to accomplish restoration.

Protection of habitat is expected to be an important element of restoration. Acquisition of title to land or acquisition of other property rights are important protection tools. Lands may be acquired or otherwise protected if it can be demonstrated that such actions contribute to the restoration of resources or services injured by the spill.

The Trustee Council is identifying lands that are important to accomplish restoration objectives. It is neither necessary nor possible to protect all habitats that would contribute to restoration of injured resources and services. We are sending this letter to a large number of owners of property rights that are potentially valuable to our restoration efforts. You have been identified as a possible owner of such property. We would like to know if you are interested in participating in our identification and analysis process. This process locates, characterizes and evaluates privately owned habitat (land) linked to the recovery or replacement of resources and services (human uses) injured by the Exxon Valdez Oil Spill.

Your response is sought for informational purposes only and is in no way binding upon you or the Trustee Council. If you indicate that you would be interested in discussions, we will contact you regarding analysis of your property and/or property rights.

Please respond on the enclosed form and return it to us. Until we receive your response we are not able to consider you a willing participant. We appreciate your consideration.

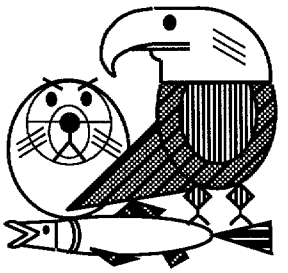
Sincerely,

James Ayers
Executive Director

Enclosures

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178



MEMORANDUM

TO: Members, Public Advisory Group

FROM: Jim Ayers
Executive Director

DATE: October 3, 1994

RE: Briefing materials for October 12-13, 1994 meeting

Enclosed are additional materials for your October 12-13 meeting in Anchorage. I would like first of all to thank you for your participation in this process. I hope that you are finding your packets useful. I want to apologize in advance for not being able to be present at your October meeting. I had definitely planned to be there until I was called to Washington D.C. that week for several days of briefings with the federal Assistant Secretaries regarding habitat acquisition, the Institute of Marine Science improvements project, the final Restoration Plan, and several other items.

I will call in sometime during that two-day period to give my report to you. In my absence, Director of Operations Molly McCammon will be available to assist you during the meeting, as will representatives of the six Trustee agencies. In addition, Dr. Robert Spies will be available the afternoon of October 12 and all day October 13. I have made sure that the expertise you will need in order to develop your recommendations on the FY95 Work Plan will be available. I want to assure you that your comments and recommendations will be a part of my final consideration.

Habitat Protection and Acquisition - In your September packet you received a copy of the negotiation status summary for your information. I will provide additional details in my teleconferenced report.

Restoration Plan - The Final Environmental Impact Statement for the Restoration Plan has been published. The Record of Decision will be available for signing on October 31. Following that, the Trustee Council will take action on a Final Restoration Plan at its November 2-3 meeting. You should already have received under separate cover a copy of the Final EIS. Please let the Anchorage Restoration Office know if you have not. The Restoration Plan will serve as the general guide for the Trustee Council's restoration actions in the future.

Oil Spill Public Information Office - At your July meeting you requested a report on OSPIC. That report was provided in your September 7 briefing packet. Ms. Carrie Holba will be available at the October 12 meeting to respond to any questions you may have concerning the OSPIC.

PAG Member Issues/final report - Molly McCammon received responses from five PAG members, which are enclosed. A summary of these five will be provided on October 12.

Institute of Marine Science Infrastructure Improvements - A revised project purpose and description has been prepared, and a copy is enclosed as a separate document for your information. The project team will be presenting a detailed briefing on this project at your meeting.

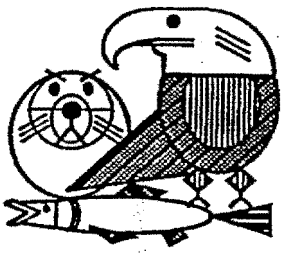
1995 Work Plan - By now you should have received copies of the Brief Project Descriptions for all project proposals submitted for consideration in 1995. Detailed budget information for each proposal is available if you desire. Please be sure to bring the project descriptions and the Draft Work Plan Summary with you to the October 12-13 meeting. We will have for your use at that time a summary of the comments received during the public comment period, and the Chief Scientists' recommendations. These will be displayed on a spreadsheet that you can use as a worksheet as you go through the Draft Work Plan. Dr. Spies will be available during this meeting, as will agency representatives who can "speak" to individual projects.

PAG Charter - The PAG Charter has been renewed for another two years. The submission deadline for nominations to the PAG was extended until October 31.

Trustee Council Meetings - The Trustee Council is meeting October 5 in Juneau for a briefing on the Institute of Marine Science project and an executive session on habitat acquisition strategies. The next meeting is scheduled for November 2-3 in Anchorage.

Exxon Valdez Oil Spill Trustee Council

Public Advisory Group
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone 907-278-8012 Fax 907-276-7178



AGENDA

Exxon Valdez Oil Spill Trustee Council
Public Advisory Group
First floor conference room
645 G Street, Anchorage, Alaska

Wednesday and Thursday, October 12-13, 1994
8:30 a.m.

DRAFT
10/3/94
1:30 p.m.

PURPOSE:

1. Prepare a PAG issue paper as a "final" report for this term of the PAG.
2. Obtain status reports on restoration activities.
3. Make recommendations on proposed activities and projects for the 1995 Work Plan.

Tuesday

8:30 a.m.	Call to order/roll call/ approval of agenda	Brad Phillips, Chair
8:35	Approval of summary of August 2-3, 1994 meeting	Brad Phillips, Chair
9:40	Executive Director's Report	Jim Ayers, Executive Director (By teleconference from Washington, DC)

-- Habitat Protection and Acquisition

-- Restoration Plan

-- Final EIS
-- Final Plan

10:00	-- Oil Spill Public Information Center Usage	Carrie Holba, OSPIC Director
10:10	-- Institute of Marine Science Infrastructure Improvements	Project Team
10:40	-- PAG member issues/final report	Brad Phillips, Chair
11:40 a.m.	Working lunch	
12:30 p.m.	Introduction to the 1995 Work Plan	Molly McCammon Director of Operations
1:00	Briefings/discussion on proposed projects for the draft 1995 Work Plan	Dr. Bob Spies Chief Scientist
4:00	Public Comments	
5:00	Recess	

Wednesday

8:30 a.m.	Recommendations on the 1995 Work Plan	Brad Phillips, Chair
11:30	Lunch -- on your own	
12:30	Continue recommendations on the 1995 Work Plan	
4:00	PAG member comments	
4:30 p.m.	Adjourn	

To: Doug Mutter, PAG Fed. Officer 8/12/94

Fr: Jim King, PAG Conservation Member

Sub: EVOS Settlement Issues, 1994

Herewith some of the issues I would like to see discussed at the October PAG meeting. I hope they are useful questions. It is an incomplete list and I trust those more knowlegeable will articulate issues for fisheries, archeology, recreation and so forth.

1) Good conservation dictates sustained yield where possible. Should that concept be applied to Settlement funds and a major portion be used for long term/permanent resource enhancement rather than for short term restoration efforts? Yes! Maybe! No!

2) Some elements of the ecosystem can easily be classed as restored, some elements unrestored and some elements in need of long term scrutiny to determine what restoration effort is needed. Should the ecosystem rather than a collection of some of its parts be recognized as the damaged resource? Yes! Maybe! No!

3) Can the "ecosystem approach" to restoration really be achieved by the current program of invited proposals rather than through a coordinated assault by a well directed team? Yes! Maybe! No!

4) Two thirds of respondents to the "EIS brochure" favored establishment of a permanent endowment with some of the Settlement money in hopes of eventually achieving resource enhancement? Should the Trustee Council request that the federal solicitors try to find a way to accommodate this majority interest? Yes! Maybe! No!

5) Would it be better to modify and perfect existing bureaucracy, for instance the University of Alaska Foundation, to manage an EVOS endowment rather than invent a new organization? Yes! Maybe! No!

6) Establishing permanent academic chairs with responsibility for developing an understanding of the ecology of the major damaged resources through graduate study projects would produce peer reviewed publications and EVOS area trained scientists as well as good science. Would endowed chairs ultimately provide greater public benefit than contract research? Yes! Maybe! No!

7) Though tempting, is it appropriate for agencies to try to compensate for declining budgets by appealing for EVOS money to fulfill legislative mandates for resource monitoring and research? Yes! Maybe! No!

8) There are clearly conflicts between the 1971 Alaska Native Claims Settlement Act and the 1980 Alaska National Interest Lands Conservation Act. Is it appropriate or even possible for the Trustee Council to try and moderate any of these Congressionally created problems with EVOS Settlement funds? Yes! Maybe! No!

9) Where habitat protection is the objective the public interest and long term restoration goals can best be served by fee simple purchase. Yes! Maybe! No!

10) Everyone agrees birds, some of which have an ecosystem that spans North and South America or the entire Pacific Ocean, suffered major losses from EVOS but because there was very little pre spill data it is difficult or impossible to determine what the losses were and whether restoration is being achieved. There has been very little effort so far on behalf of the birds. The Trustee Council should review restoration policies which were largely conceived to help better understood resources and see if there may be some innovative ways to do something for birds. Yes! Maybe! No!

11) Is there a danger that in 2001 and beyond there will be a public perception that the resources largely recovered on their own, special interests got the money and society benefitted very little from the EVOS Settlement? Yes! Maybe! No!

Jim King

September 1, 1994

Exxon Valdez Oil Spill Trustee Council
645 G. Street
Anchorage, Alaska 99501

ATTENTION: Jim Ayers, Executive Director

Dear Jim:

While reading the Ecosystems based restoration proposals, and the large dollar amounts which accompany them, sitting through the work session and watching the evaluations of the proposals. I feel with the draft restoration plan and the scientific team, we are almost on the right track. We know not everyone will be satisfied, but at least it's a step in the right direction.

The Public Advisory Group recognized the need for proper direction; it was also our feeling we were not getting the proper recognition or included in the process. I can now see this is beginning to change. I do feel, although we are only in and advisory position and are the representatives of the citizens of Alaska; that needs to continue. I feel Director Ayers is taking very careful long strides to get things lined up properly and efficiently.

I agree with the rest of PAG members, we need an endowment/reserve for future generations of research.

I also agree with some that trying to purchase habitat is not the answer either. With the spruce Bark Beattle infesting the timbers in PWS, are we not purchasing dead forest that cannot serve as habitat anyway?

The Public has been very disallusioned on how the Exxon funds have been spent and everyone sees the dollar as something they should have in their area or organization.

With this new team, I believe things will go in a better direction, cost, effectiveness and damage will be the major components. At this point I believe we can endorse what Jim Ayers is trying to accomplish, express our concerns, support and work with him.

The draft restoration plan at least is something to work with and does provide long term guidance, I encourage endorsing the concept of it for right now.

Recreation has increased because of the spill, there are more businesses for recreation in PWS than ever before. This area will continue to grow. Significant earnings are really being made here.

The Native concerns, ideas and history should be a priority, lessons of the past and into the future will give us a better understanding of the Sound. But we must ask and then we must listen to the answers...if so, everyone will understand and learn.

I am looking forward to the future years of serving on the Public Advisory Group with most of the same people that have been here. It's been and honor.

Respectfully,

Donna M. Fischer
Co-Chair, Public Advisory Group

RUPE ANDREWS
9416 LONG RUN DRIVE
JUNEAU, AK 99801

August 29, 1994

Ms. Molly McCammon
Director, Operations
EVOS-PAG
645 G Street , Suite 401
Anchorage, AK 99501-3451

Dear Molly:

Re the last PAG meeting, members of PAG were requested to compile issues that they consider important and submit them to you by September 1. I would like to put forth the following notion for consideration by the Trustees if and when the opportunity may occur. I propose that the Karluk River on Kodiak be considered for purchase as replacement for lost angling opportunities due to the oil spill in PW Sound. The past two years I have seen that anglers and sport hunters essentially will derive little consideration from the oil spill settlement unless there is the chance to purchase a system such as the Karluk River to replace lost angling opportunities.

I am aware that this river is not on any list by the land owners for possible purchase. The Karluk has only been vaguely discussed by some of the trustees and some trustees may not have heard of the river. Arguably, the Karluk is the best wild, steelhead stream left in North America. It should be in public domain and under the protective land classification of the Kodiak Bear Refuge. If the land owners are reluctant to sell then public access and a mutual land management plan should be explored,ie., less than fee simple purchase.

I have no alternative options for sport anglers of lasting benefit. The Karluk River is priceless for the recreational benefits that it offers to sport anglers and worthy of discussion at the October PAG meeting.

Sincerely,

Rupe Andrews

Rupe Andrews, Member, EVOS-PAG
Sport Fishing-Sport Hunting Representative

P.O. Box 868
Girdwood Ak. 99587
9-8-94

Molly McCammon, Director of Ops.
EVOS Restoration Office
645 G Street, Suite 401
Anchorage, AK 99501

Molly McCammon:

During the past two years, I have learned much about the damages to and the restoration of Prince William Sound in this post oil spill era. I volunteered for a position on the PAG to learn these things, but in the process of informing myself I have learned even more.

In the past year I have witnessed the transformation of an agency generated structure into something with so much imput from the public, from private researchers, and from government agency personnel that the collective imput when ranked and presented in open forums by experts and private citizens cannot be ignored. The infrastructure set up by Jim Ayers' team has been impressive and effective. The 1995 Draft Work Plan is the proof of the pudding.

The next phase of carrying this draft Work Plan, with all its competing proposals, to fruition is daunting.

My chief concern is that the EVOS settlement not be used to create an agency driven research juggernaut that arbitrarily displaces local private researchers from their historical roles. If settlement funds are used to build a research center in Seward, then how much say will state and federal agencies have in the allocation of research funds from settlement monies?

Right now I am very happy with the layers of of accountability that Jim Ayer's team has built into the research proposals. I hope that private entities will continue to be involved in future proposals, because the quality of the 1995 Draft Work Plan has been greatly enhanced by their participation. It is important that the best of these private parties now participate in the actual projects to ensure their future involvement in the restoration process.

Please keep up the good, although difficult work. You have my greatest appreciation.

Sincerely,

James A. Diehl,
recreational users

Lew M. Williams, Jr.
755 Grant Street
Ketchikan, Alaska 99901

August 31, 1994

Molly McCammon
Director of Operations
Exxon Valdez Oil Spill Trustee Council
645 G. Street, #401, Anchorage 99501
FAX 276-7178

Dear Ms. McCammon:

In response to a request of members of the Public Advisory Group for their opinions on restoration direction, here is my opinion as a public member:

GUIDELINES --

Some brief, simple guidelines - following the court decision - are needed for those who apply for restoration grants, for the restoration team, for the public advisory group and even for the trustees. And each segment should know the guidelines for the others.

My understanding from Executive Director Jim Ayers is that the court has said that a restoration plan should be devised that:

1. Provides for general restoration.
2. Provides habitat protection with acquisition of only critical high-value habitat.
3. Provides for monitor and research of the affected area.

And the EIS will allocate money to those three items.

In reviewing restoration projects, the restoration team puts them in five categories.

Under a policy adopted by the Public Advisory Group, priority should be given to:

A. Picking up oil which is fouling the environment.
B. Restoring injured resources and services by direct action.
C. Protect habitat critical to resources injured by the oil spill.
D. Establish an endowment, trust or reserve so there is income after Exxon makes its last payment.
E. Replace injured resources and services by indirect means, i.e. enchance equivalent resources to reduce pressure on injured ones.
F. Provide funding for facilities which support A through E.

A further policy statement by the Public Advisory Group lists tools for protecting habitat aside from acquiring fee title. They include conservation easements, acquiring partial interest, acquisition of timber rights and term easements, land exchanges and cooperative agreements.

WITH ALL OF THE ABOVE from the court, the restoration team and the public advisory group, I think someone can come up with a one page list of guidelines that will guide everyone.

It is much better to have a positive policy statement and guidelines instead of a list of negatives which come to mind:

--No economic development projects are eligible for funds.
--No projects considered outside of the designated spill area.
(I'm sure the staff can think of other no-nos from the list of applications for funds.)

A positive WAY TO EXPRESS THINGS COULD BE: Funds are intended for restoration of STATE resources. Fishermen, communities and businesses have to look to other court settlements for their restitution.

RESERVE ACCOUNT --

I am pleased that the trustees are considering a reserve account of up to $130 million, the earnings of which will finance monitoring and research long after Exxon makes its last payment in seven years. My fear is that the amount of earnings available at from the reserve that time means a sudden drop in restoration effort from the level of the previous seven years. The cost of administration may eat up a high percentage of those reserve earnings.

So, I think a program of gradually using the reserve and earnings and gradually shutting down the program by 2029 or some other date is appropriate. Sosmeone good with figures should be able to figure out something. For example: The program for 2002 might be 20 percent of 2001 (the last year of the Exxon contribution) the program for 2003 is 30 percent of 2001 and so forth.

After all, we should assume that there is a time resources will be restored and monitoring should go to the state and federal agencies as part of their regular programs.

LAND ACQUISTION --

Acquiring fee title to habitat is controversial. The Alaska Coastal Rainforest Campaign, a group of seven environmental organizations, advocates using as much of

the spill settlement funds as possible to acquire land for a huge wilderness extending from Kodiak to Ketchikan. On the other hand, there are those who want no land acquisition and one Native timber company official has said publicly that his group won't give up one acre.

There has to be a compromise. And it should meet the primary goal of the settlement of restoring the resource. That is why alternatives to fee simple title should be considered. We must assume the resource will be restored at some point in time. Putting land under government title permanently, when there is going to be a time when the resource is restored, isn't sensible. Some land should go to government, preferrably to the state, to complete parks or reserves. But not for creating a vast reserve for the purpose of creating such a reserve doesn't follow the intent of the settlement.

I certainly hope to see more discussion and guidelines on habitat protection or better understanding of what we have to avoid clashes of interests.

ENDOWMENTS (again!) --

Some members of the public advisory group are pushing for endownments for the University of Alaska despite an opinion from Justice Department lawyers that it isn't possible.

It appears to me that if the University or Prince Williams sound Community College, or any other research agency, wants to endow a chair, they should request it as a project. For example, the institution should describe specifically what it would do in research and monitoring over a periord of years and request $2 million to finance it. There are enough years left in Exxon payments and work project years that up to four chairs could be endowed. It should be confined to institution within the spill area.

These are just a few of my ideas. I'd like to reiterate what I said at the last meeting: When dealing with legal advisors, ask them how to reach the goal and not ask if such-and-such is legal. It's too easy to say no. Most lawyers can find an answer if they are asked how to reach a goal.

Sorrty to be late with this. I'll mail a hard copy later.

sincerely,

Lew (Llewellyn) M. Williams

Institute of Marine Science
Infrastructure Improvements
EVOS Trustee Council Project #94199

PROJECT DESCRIPTION

AND SUPPLEMENTAL MATERIALS

prepared for the
Exxon Valdez Oil Spill
Trustee Council

DRAFT September 26, 1994

Exxon Valdez Oil Spill Trustee Council

Restoration Office
645 G Street, Suite 401, Anchorage, Alaska 99501-3451
Phone: (907) 278-8012 Fax: (907) 276-7178

MEMORANDUM

TO: Agency Liaisons

FROM: Jim Ayers
Executive Director

DATE: October 3, 1994

RE: Comments on Draft Record of Decision

Copies of a draft Record of Decision on the Final Eis for the Restoration Plan were distributed to all agency liaisons last week. Please have your agency's comments back to Rod Kuhn in the Anchorage Restoration Office by the close of business on Wednesday, October 12. Since the text for the R.O.D. is essentially verbatim from the FEIS, the Draft Restoration Plan, and a small amount from the brochure, this is not the time for wordsmithing. However, I would like to ensure that all agencies have reviewed and agree with the major concepts in this draft.

I am also attaching a timeline for action on the R.O.D. and the Final Restoration Plan. The major issue still outstanding is who, representing the Federal Trustees, will actually sign the R.O.D. Each of the federal agencies needs to decide this as soon as possible. I'm assuming that Alex Swiderski in the Department of Law is preparing a brief letter of concurrence for State Trustee signature. By way of this memo I am asking the state liaisons to work with Alex in preparation of that letter.

Let me also remind you that October 12 is also the date for returning your comments on the preliminary Final Restoration Plan draft to Bob Loeffler and Veronica Gilbert.

cc: Rod Kuhn
Alex Swiderski
Molly McCammon

FINAL EIS/RESTORATION PLAN TIMELINE

	From	To
Notice of FEIS availability in Federal Register	9/30	9/30
30 day waiting period on FEIS	9/30	10/30
Agency review of Draft R.O.D.	9/28	10/12
Agency review of preliminary Final Restoration Plan	9/30	10/12
Prepare R.O.D. for transmittal to Washington D.C.	10/13	10/14
Revisions to preliminary Final Restoration Plan	10/13	10/20
Final review & briefings in preparation for R.O.D. signature	10/15	10/30
Final review of Final Restoration Plan	10/21	10/30
R.O.D. signature	10/31	10/31
R.O. D. printed and distributed	11/1	11/14
Final Restoration Plan adopted	11/2	11/2
Final Restoration Plan printed & distributed	11/3	11/31